THE

ELECTRICAL REVIEW.

VOL. LXXVII. NOVEMBER 12, 1915. No. 1,981.

ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: November 12, 1915. [No. 1,981.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.

DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.

JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.

LAUNCESTON: Gordon & Gotch, Cimitiere Street.

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto 1° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

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EUROPEAN ELECTRICAL COMPANIES IN WAR TIME.

THE influence which has been so far exercised by the war on electricity supply works, tramways and certain other electrical undertakings on the European Continent, has been of a varied character, and has depended upon a variety of factors which differ according to circumstances. Among these may be borne in mind the particular country concerned, the location of the undertaking in relation to the actual area of war, the withdrawal for military purposes of large numbers of the employés and the substitution of less skilled workers and of female labour, and the reduction in consumption and traffic on the one hand, whilst on the other an advance in the use of electricity has taken place in some cases for meeting the additional requirements of works or factories engaged on army contracts, and also for affording a substitute for the scarcity of petroleum where formerly used for lighting. At the same time it has to be remembered that, although the war has continued for over 15 months, no single undertaking has yet been able to record the financial results for a complete period of twelve months of war, one or more peace months being generally included in the year's working; and in the case of those concerns whose financial year terminates with the calendar year the former naturally only comprises five months of war time.

It might be thought from the fact that Berlin is one of the principal centres of the electrical and mechanical engineering industries, and is largely engaged on war work, that the consumption of electrical energy in the twelve months ended with June, 1915, would have experienced an increase. But the figures which have just been issued by the Berlin Electricity Works Co., which has hitherto had a monopoly of the public supply in the capital, show that this assumption is incorrect. The consumption, in fact, has declined from 267,589,000 KW.-hours in 1913-14 to 252,762,000 KW.-hours in 1914-15, owing to the war and the displacement of the ratio borne by lighting to power purposes, and the dividend on the ordinary shares has fallen from 12 per cent. to 9 per cent. In the case of the city of Hamburg the outbreak of the war at first caused a large diminution in the consumption, amounting to as much as 25 per cent. in individual months. At the beginning of 1915, however, a perceptible improvement took place, particularly on the introduction of a new tariff for large consumers, but it was impossible to equalise the decline in the first half of the year, and the consumption recorded by the Hamburg Electricity Works Co. is returned at 43,453,000 KW.-hours as

against 45,146,000 KW.-hours in 1913-14, and the dividend 8 per cent. as compared with 8½ per cent.

The Alsace Power Station Co., of Schlettstadt, is one of the few undertakings whose works are directly situated with the theatre of war, although its financial year ended on April 30th, 1915. But the effects of the war were only of a transitory character. The production, which amounted to 525,000 KW.-hours in July, 1914, as compared with 321,000 KW.-hours in the corresponding month in 1913, receded to 190,000 KW.-hours in August, but after the battles in Alsace the output rose to 360,000 KW.-hours in October and to nearly 400,000 KW.-hours in December. The mains to Markirch and the Weiler Valley were interrupted in August, 1914, but were subsequently restored, no great damage being done to the mains and transformer stations or to the mains and buildings in course of erection. The net profits have not been sufficient to enable the payment of a dividend, but this was also the case in 1913-14. A similar observation in regard to the financial results also applies to the Lorraine Power Supply Co., of Metz, which, being close to the war area, suffered to a greater extent than the undertakings more in the interior of the country. It has also been necessary to postpone until the end of the war the projected extension of feeders and local distributing networks. On the other hand, the Oberhausen Electric Overland Central Station Co., although having been adversely affected by the war, is yet able to pay 6 per cent. for 1914-15 as in the preceding year. But in this instance also the development of feeders and of local networks has had to be postponed.

If there is one district more than another in Germany where a great expansion in the consumption might have been expected it is that of Rhenish-Westphalia, on account of the many collieries, iron and steel works, and engineering works which are located in this particular province. Yet the progress, judging from the working results of the greatest undertaking in that area, has been by no means very remarkable. Situated in one case, if not also in two cases, on the pit bank, the value of the connections of the works of the Rhenish-Westphalian Electricity Co., of Essen, increased from 320,000 KW on June 30th, 1914, to 357,000 KW. in the same month of 1915, the number of glow-lamps from 1,300,000 to 1,400,000, and the number of motors from 34,000 to 37,000 in round figures. It was, however, impossible to secure a corresponding augmentation in the consumption, which advanced from 290,048,000 KW.-hours in 1913-14 to 293,002,752 KW.-hours last year. The company also supplies gas, of which 26,895,374 cubic metres were transmitted by means of the long-distance mains, whilst a further 4,350,294 cubic metres were furnished by the company's gasworks at Rotthausen, Borbeck, Mattmann and Dulken. The dividend, which absorbs £200,000, amounts to 8 per cent., as in 1913-14. A smaller undertaking—that of the Berggeist Electricity Works, of Bruhl—also succeeded in effecting a larger turnover, the consumption having advanced from 34,298,000 KW.-hours in 1913-14 to 56,511,000 KW.-hours last year. In this case the company experienced a reduction on the advent of the war, but a considerable increase as compared with the equivalent months in 1913-14 soon took place as a result of the many industries supplied, which were chiefly engaged on war work.

If consideration is now given to the financial results of a number of companies distributed over the European Continent, it will be found that they have in general succeeded in maintaining for 1914 or 1914-15 the rates of dividend which were paid in the preceding year. Even in the case of the Italian companies, whose best results are mostly for 1914, the figures would be less satisfactory than they are were it not for the large use of water-powers in that country, as although Italy did not participate in the war until May, 1915, the coal question has played a part in the economic and industrial life of Italy since the outbreak of the war as it has done in other countries. We give in our War Items a table showing the dividends of a number of companies for the two years.

Although the financial results quoted above are in general favourable, a more definite opinion of the real effects of the war on the companies will only be ascertainable when the working figures for the whole of 1915 or 1915-16 become available.

Putting the Loss on the Rates.

A CORRESPONDENT has informed us that, according to one of our contemporaries, an Irish County Court Judge has laid it down that where a local authority is running a municipal electrical undertaking at a loss, the loss must be made good, not out of the rates, but by raising the price to the consumer. It is pointed out "that if future new undertakings are restrained by law from deriving any support from the rates, and have to increase the tariffs of electricity supply to an extent sufficient to recoup the initial losses, it will be almost impossible to develop any new undertaking." Whatever the result of this alleged decision—which is said to have been pronounced two years ago—we should very much like to see a full report of the facts, arguments, and judgment, before accepting it as final. So far as can be ascertained there is nothing in the Electric Lighting Acts, 1882, 1888, 1899 and 1909, which, with a slight variation referred to in Sec. 37 of the Act of 1882, apply to Ireland, which in any degree controls the action of a local authority in the matter of charges for electricity. It is presumed that the matter came before the County Court Judge by way of an appeal from a surcharge or disallowance of something improperly charged upon the rates; but even in that case we fail to discover anything in the Public Health Acts which confers such a power upon an auditor or any other person.

Trade in South Africa.

ON another page we print some extracts from a report on the trade position in South Africa, by Mr. H. E. Gauntlett, who is acting as H.M. Trade Commissioner for the Union now that Sir Sothern Holland has joined the Home Staff of the Board of Trade. A perusal of this illuminating report, which comprises over 100 pages, will repay any manufacturer or exporter. The very much greater extent to which British firms have taken advantage of the organisation of H.M. Trade Commissioner's Office since the war began proves, to Mr. Gauntlett's mind, that one of the most apparent failings of the British manufacturer lies in deferring his efforts until the position is critical, instead of taking early steps to prevent the crisis. German trade was as worthy of capture years ago. In this connection some pointed remarks are contained in the Report as to the necessity for catering for the exact needs of the market. The British manufacturer may see no good or immediate

reason for reducing the high quality of his output, or varying his standards, to meet the demand of a new market which is not educated up to purchasing a superior article.

But it can easily be understood that a firm whose turnover in the "up-country" (or native) trade of, for example, the South African market, has been enormous, will have made a name amongst the big importing firms. When, in due course, the importers demand a better quality of the articles they have handled so successfully in the past—which demand must arise from the steady improvement in the standard of living—they will naturally give to their regular oversea suppliers the first opportunity to satisfy their new requirements, and they will rarely find that a foreign firm cannot supply such needs. To this condition of affairs Mr. Gauntlett attributes the decline of trade in many lines experienced by British firms in the past few years.

When in August last year Germany's trade campaign was brought to a sudden stop by the outbreak of war, H.M. Trade Commissioner assured the Chambers of Commerce throughout South Africa that British manufacturers were making concerted and unprecedented efforts to capture in the South African market the trade which hitherto had gone to Germany and Austria; and that these efforts comprised not merely improved organisation but the manufacture of goods practically identical with those to which the market has become accustomed. The Board of Trade here has been giving our manufacturers an opportunity of inspecting samples of German and Austrian goods which have succeeded in such markets. The question arises then: will British manufacturers stand by the Commissioner's assurances by seizing the first opportunity of suiting their output to this market's requirements, and thus show their appreciation of the practical assistance which has, in this connection, been given ungrudgingly to British trade by certain South African firms?

Germany's exports to the Union in 1913 amounted to £3,500,000. This is obviously worth adding to the figures of any country in a position to manufacture the goods. The American pre-eminence in labour-saving method—which goes far to counterbalance Germany's cheap labour—is enabling the United States to reap a rich reward at this juncture. Mr. Gauntlett's view is that the American share in South African trade is mainly limited by her lack of direct steamship communication.

We do not wish to revive the cry: "Business as Usual," whilst the engineering trade of the country is rightly devoting itself almost entirely to war work, but in view of Mr. Asquith's recent warning as to our vanishing export trade, we feel justified in emphasising the point Mr. Gauntlett makes, viz, that, in allowing the South African market to be controlled increasingly by foreign suppliers of "cheap" lines, British manufacturers will be adding to the strength of their competitors, which strength may be in due course diverted to opposing the position now held by British firms in the markets of the United Kingdom, the Continent, and elsewhere.

The Wire-Drawing Industries.

Now that nearly all the most important wire-drawing firms in this country have been put under Government control, it is generally expected that the demands for supplies from private sources, which in some sections have tended to diminish slightly during the past month, will show a further small decline for the next few months. For the greater part of the past 12 months every wire-drawing establishment throughout the country has responded to the demands of the War Office and Admiralty, with results highly satisfactory to all concerned.

In consequence of the disorganisation and upheaval under which trade generally has been labouring during the past 12 months, it has proved no easy matter for wire manufacturers in this country to look adequately after the interests of their old customers who have no war claims for preference in the matter of deliveries. Every effort, however, has been made, often at great inconvenience and expense, to meet the requirements of this section, with the smallest possible delay.

As soon as the end of the war is within measurable distance, every effort will, doubtless, be made to forestall German and American competition in the wire trades, by adopting, throughout the home markets in particular, a still more comprehensive and effective system of personal representation than was in force prior to the war. Recent inquiries have shown that several of the chief competitive German wire-drawing firms had more agents in this country alone, prior to the war, than some of the British firms had throughout the world.

That the German system cannot be regarded in the light of a failure, or anything approaching that state, is largely proved by the past heavy exports from Germany into this country, of copper goods for electrical purposes, and it would appear not unreasonable to expect a still more vigorous attack to be directed at these valuable markets as soon as normal working conditions are restored after the war.

This attempt of the German firms to recapture their lost export trade with this country will certainly be characterised by entirely new methods when the time for action has arrived; and although the name German may be anathema in this country for many years to come, means are, we hear, being fully provided for to meet this contingency, by adopting the new plan of campaign already indirectly hinted at above. These ulterior designs on the part of the German firms, however carefully planned they may be beforehand, will probably be effectively frustrated by, among other measures, the adoption in the future by every important wire manufacturing firm in this country, of a still more adequate and comprehensive system of personal representation in every market throughout the United Kingdom.

Lead.

The market has kept up a good deal better than most people in the trade anticipated would be the case, but the fact is that lead is coming forward in disappointingly small quantities, owing partly to the shortage of labour which is making itself felt in Australia, and partly to the excessive difficulty in obtaining freight, the result being that material is being held back in the countries of origin. Until more reasonable conditions obtain in the shipping world the position in this respect is not likely to undergo any improvement. The October imports were 14,796 tons against 17,435 tons last year, making the total for the 10 months 213,192 tons, an increase of about 30,000 tons on the year, while at the same time there has been a big falling off in our exports and re-exports. The balance is undoubtedly going into the supply of munitions, and the demand for lead for this purpose must be on a larger scale than had ever been contemplated. The buying for Russia has been on a colossal scale, and this still goes on, but owing to the vagaries of our authorities there is no knowing when the lead may be permitted to go forward. First there is the difficulty of obtaining permits, to say nothing of the vexatious and unnecessary delay which occurs in granting them. Then when the permit is obtained, it is quite a common thing for the steamer on which freight room has been engaged to be commandeered.

In despair at this perpetual raising of difficulties, attempts have been made to divert the lead from Archangel to Vladivostock, but this move on the part of merchants anxious to supply Russia with munitions seems likely to be effectively frustrated by the commandeering of Vladivostock steamers. It is quite certain that Russia cannot fight without munitions, and it is equally certain that a bad impression is being created by the ceaseless difficulties put in the way of her obtaining material. The home trade here is, of course, consuming huge quantities for munitions, as has been said, but the general trade demand is decidedly quiet. Should it happen that the large quantities of lead held up because shipping facilities to Russia are so seriously curtailed must be resold, there would certainly be a substantial break in the price, but meantime the American market has moved sharply upwards, and the general position defies solution, for everything is chaotic. During September the price of soft foreign lead for prompt delivery ranged between £24 15s. and £26, and forward between £22 10s. and £23 10s. a ton.

OUR TRADING OPPORTUNITIES THROUGHOUT THE WORLD.

It has been remarked in certain high quarters abroad that the Central States of Europe have, by their deliberated efforts to dominate the world, thrust civilisation backward by one hundred years. While bloodshed and carnage continue, while the fires of Europe not only remain unquenched but actually spread and bring new combatants into the conflict, it is not surprising that there should be some to give way to sentiments or statements of that kind. But we may wonder whether those who express such an opinion have any very definite idea of what they mean by "civilisation." Our feelings in regard to the future and what it will bring may be influenced very considerably by our conception of the true meaning of the word. If we mean that what the last fifteen months has revealed to us as German *Kultur* is civilisation, then we may hope that the prophecy is correct, for the world of to-day has no room for that abomination. But if by civilisation we mean the general development of the human race and the progressive utilisation of the earth's resources by the practical applications of engineering science, industrial operation, and commercial enterprise, then we think that the forecast is one which may be disregarded. Whatever may be the effect of the present warfare among Christian nations upon the minds of those whom we generally describe as Heathen; whatever may be the loss sustained through a number of great nations sacrificing millions of their physically fittest, the flower of their manhood, and among them potential students and thinkers in many important departments of activity; whatever may be the consequences of it all to particular empires and emperors; whether the map of Europe be materially altered or not—one thing seems to us to be certain, that all the changes that may be introduced cannot take us back again to the state of things that existed one hundred years ago. We may, perhaps, get back to simpler living, may be controlled by the pursuit of higher ideals than we had a year or so ago, may perhaps have freedom from the oppressive menace of ambitions for world conquest, may be free to devote ourselves more assiduously to the arts of Peace, but we shall not go back to a world that possessed little knowledge of the elementary principles of steam generation, that knew not the laws of induction, merely played at the utilising of falling water, knew nothing to make it discontented with a rush light or a gas jet, had few railways and no telegraphs or telephones, and lived what now we should most of us regard as a monotonously sleepy and uninteresting sort of existence. The world, or the greater part of it, will inevitably be poorer for a time as a result of the terrible waste of thousands of millions of money, but who shall say that when there shall have passed away the first shocks of the return of statesmen, armies, navies, and peoples to ordinary avocations in years of Peace—God grant it may be unbroken in the aftermath of the huger conflict, by a succession of smaller ones—the development of all countries shall not leap forward once again? Of course, new development must be held up for a time; we cannot take up the thread of industrial world enterprise exactly where it was broken just over a year ago. Many schemes have been deferred; some of them will never take the form intended in the pre-war days; there will be much of change, and some of the countries of the world which looked to Europe for money and equipment and expert knowledge must hold up their cherished plans for a time. But it will only be for a comparatively brief period—not one hundred years, perhaps far less than one-tenth of that period. All the manufacturing nations will be, as a matter of sheer necessity, obliged to overrun the world again in their efforts to keep factories in operation and to repair their respective national losses. The rehabilitation of devastated lands and ruined cities will make huge demands, and somebody will have to pay indemnities; but notwithstanding these reconstructional operations and financial manipulations the world will not be stopped in its clamouring for progressive development. Can it be imagined, for instance, that our great Colonies and dependencies will remain at a standstill, with all the germs and possibilities that lie within them as the outcome of enterprising measures of the last few decades? Can it be supposed that the vast market of China will return to slumber after the awakening westernising movements of recent times? Can it be thought that the engineering lessons of this war will leave the vast resources of Russia still unutilised? Is it to be supposed that with America's manufacturing ability unhindered, with her taste for foreign effort in trade made keener, with her money-bags well filled, or with our own manufacturing capacity enlarged as the result of factory extension for war purposes, and with the large accession of formerly unemployed or unskilled labour into the ranks of, more or less, skilled working life of this country—things of the development class are going to be at a standstill? Even this mere cursory statement of the case is its own answer to the suggestion of a century set-back.

It may reasonably be supposed that in some countries it will not be easy to raise money for large enterprises such as the world will be calling for, and in this matter of future finance we can only see through a glass darkly. We are not all able to remember it, but many do, and for all of us it is in the records, that after the Franco-German struggle of just over forty years ago, France recovered her position in a remarkable and unexpected manner. That was only a small affair, comparatively speaking, and what is happening now must have farther-reaching effects, but they will be spread over many countries, and the recovery may be more rapid than the signs may lead us to anticipate.

It is interesting to fall back for a few minutes into the frame of mind that was ours five or six years ago, when we tried occasionally to conjure up before our imagination the vastness of the opportunity that scientific and engineering discovery and achievement, and the general forward movement among men everywhere, seemed to be opening out to us. At that time we endeavoured in these pages, as we have done consistently ever since, to keep the larger outlook in the mind of the British manufacturer and trader, and to induce those having responsibility in these departments of electrical and engineering work to lay themselves out to take advantage of the occasion. In those days the influences of German industrial and financial competitors were gathering considerable strength, and if we could have presented a massed army of operators in the fields where they were active, and could have protected our reputation and our interests against the enemy's insidious attacks and deeply-laid machinations, and could have re-arranged our home manufacturing facilities, supported with adequate financial co-operation, we should not have to hear the stories that reach us of the success which has been attending our rivals' efforts. The tentacular hold of the enemy upon the markets where merit for merit we ought to have held sway, or at least progressed along the lines started by our enterprising forefathers in those fields, would have been a less harmful thing than it is to-day. Our brave Colonial forces under Botha have smashed German influence in Africa; the British flag floats gloriously in other once-German colonies; and our magnificent Navy has swept the seas clean of German ships. But neither military nor naval effort can directly sweep out the influence of the Teuton in many of the countries where his active and thorough agents have secured concessions, developed interests, and nursed the people's customs, fostering and satisfying their needs, until to-day German trade has made itself almost as great a menace

commercially as the enormous German military forces were generally to the liberties of the entire world. But we did not organise, we did not co-operate, we did not tackle the situation whole-heartedly—perhaps we could not, perhaps we were short of money, perhaps the profits of British electrical manufacturing left us too small a margin, perhaps the Continental connections of some of our firms rendered big co-operative or amalgamated schemes impossible—and now we have got to deal with those markets in ways best suited to the prevailing and prospective situation. Let us hope that somehow the Government will come to our aid with export bounties and with a more generous attitude toward technical attainments; or let us suppose that the enemies will have to pay so heavily that they will have to loosen their hold on some undertakings where their bands have been growing tighter; or let us hope that the anti-German sentiment will assist us in many parts of the world. These things, or some of them and possibly some others, will probably operate in our favour. But is there a British manufacturer to-day who thinks that they will suffice for the needs of the approaching times, without some real, thorough-going effort on the part of the whole British electrical and engineering industries? The time for many little costly efforts to win the world has now passed away. What shall we do to be entirely ready when there shall have burst in Germany that last British or French shell which shall precede the call for a truce, to be followed by Peace, when the last miserable German shall have outraged common decency, the last devilish Zeppelin shall fail to return to its den, when the hope of Von Tirpitz shall have gone down with his last submarine, or the starving hosts of the Central Empires shall have stormed the strongholds of Prussian militarism?

We fully recognise the difficulties that stand in the way of efforts to immediately deal in detail with the trade position as we shall find it at the close of the war, but we are still of opinion, as we have been for the past twelve months, that during war-time we must elaborate our schemes for peace-time. Certainly those who can afford to be active now will stand to gain most when, later on, our private manufacturing and exporting activities are less restrained. It is our desire to assist to the full limit of our power, any organisations and firms which may be occupied with deliberations in this connection, and to that end we shall publish during the next few weeks a good deal of information that has been prepared by expert observers, consuls, and others, in markets in which we may hope to stand better in future than we have done recently. Whatever may be the shortcomings of our Governmental commercial and consular services, we shall commit a great error if we shut our ears to the advice that our representatives are giving us just now. We begin this week by publishing an abstract of the report of H.M. Acting Trade Commissioner in South Africa.

TRADE IN SOUTH AFRICA.

Mr. H. E. Gauntlett, who is in charge of the office of H.M. Trade Commissioner for South Africa, has written a highly interesting report on the trade of the Union (and Rhodesia) for the year 1914. This has just been issued by the Board of Trade,* and below we summarise the portions of it which concern the electrical manufacturer and contractor.

By separating the trade returns for the months preceding the war from those for August to December, and making a comparison with the corresponding periods respectively of 1913, it is evident that the trade of the country up to the time of its outbreak was below normal. The reasons for this are, in their order of increasing importance:—

Drought (especially in the Orange Free State Province).
Slump in the ostrich feather industry.
The aftermath of the January strike.

But the ill-effects of these adverse factors continued, and to them must, of course, be added the two other chief causes of loss of trade, viz.: The European War and the Rebellion in South Africa. The rebellion produced throughout the whole country a feeling of insecurity, and merchants (who were, because of the European war, already sufficiently nervous about adding to their stocks the normal quantities ordered in the past) refrained from indenting to the extent for which they otherwise were prepared. It will be less easy for merchants to recover the trade that might have been done but for the rebellion, than it would have been for them to have maintained the trade that was being done before the local unrest arose. For these reasons, therefore, I do not anticipate that trade in the immediate future will be much greater than it was during the closing months of 1914.

Although the great dependence of the Union upon its mineral production may in certain circumstances prove an economic weakness, the greatness of its mineral wealth has been, in existing abnormal conditions, an important factor in preventing a far more serious crisis than the country was called upon to face.

The percental decreases in imports are smaller in the case of electrical material and miscellaneous machinery than in almost any other class of goods, owing to their close connection with the mining industry. Nevertheless, the drop in the imports of electrical material is disappointing. During the first eight months of the year it had increased by £73,000. The import trade of the last four months altered this amount to a loss of £17,600 on the imports of 1913. The comparative figures are interesting:—

1914 COMPARED WITH THE SAME PERIOD IN 1913.

	First 8 months.	Last 4 months.	Total for the year.
	£	£	£
Machinery	+ 73,000	– 90,600	– 17,600
Wires and cable	– 29,500	– 27,000	– 56,500
Fittings and posts	– 8,000	– 24,000	– 32,000
Telegraph and telephone material	– 1,000	– 2,500	– 3,500

Union Government Imports.—From the British exporter's point of view, the Railways and Harbours Department is by far the most important spending department of the Union Government. The Department postponed considerable expenditure which was planned for 1914, including £43,000 on electric cranes at Table Bay. Restriction of Government expenditure on imports is to be faced in 1915, and a decrease may be looked for in expenditure on the establishment and maintenance of general public works. This must of necessity have a detrimental effect on trade generally.

Future Trade.—Although there is need for care on the part of business men, the present depression is mainly artificial. The country has a great recuperative capacity, and cannot help rising in prosperity, probably soon after the difficulties of the immediate present disappear. For one thing, the possibilities of South Africa as a meat-producing and exporting country have hardly yet been realised; when they are, ostrich farmers, many of whom are now growing lucerne, will realise that the ostrich feather slump of 1913-14 was not an unmixed evil. Lack of capital for industrial purposes generally is a drawback which may not soon be overcome, although there is still a considerable amount of money in the Union that could profitably be employed in helping the country forward. The balance due at the end of last year to depositors in the Post Office Savings Banks was £6,300,000. If South Africa avoids the difficulties due to the careless investment of capital, the overburdening of stores with stock, and too heavy immediate borrowing, there is room only for optimism, and there is no adequate reason why the subsequent prosperity of the country should not be ensured, or why British firms should not secure a great share in the increasing import trade that must accompany its progress.

Capture of German Trade.—At the commencement of the European war, the "Capture of German Trade" appealed not as a mere phrase to British manufacturers. In Dominion markets, also, this ideal gripped the imagination of the "man in the street" more than that of the importer. The latter recognised that practical difficulties, not evident to the consumer, would appear as soon as the war was over, since the ideal thus expressed would, of necessity, strike at one of the main principles of commercial ethics, namely, buying in the cheapest market.

Cheap trade is a matter upon which I wish at this point to make myself perfectly clear. It is admitted that a certain quantity of trash comes into South Africa, and is bought by natives and "poor whites," often under serious misapprehension. These are not the "cheap" products referred to when I use this word; what is meant is a cheap grade of a quality compatible with (and sometimes in advance of) its low price—either goods which, in the better qualities, meet the needs of a white population, or those which are used almost solely by natives, but are intrinsically worth the low price paid. No manufacturer needs to be told of the great success that has followed German efforts to cater for this class of trade.

Reasons of German Success.—To account for this success there are many reasons which are difficult to classify, since they are closely inter-related. Finance enters very largely into the matter. Subsidies are known to have been granted by the German Government by means of exceptionally low transport rates upon certain goods for export, and, in addition, there are German trusts, or rings, whose object is the establishment of a strong position in the world's markets, achieved by means of the many advantages incidental to such combines.

One advantage the combines gain is in their oversea organisation. Instead of, say, half-a-dozen travellers being appointed by as many firms to push their several interests in oversea markets, *in competition with one another*, the same number

*Wyman's: Price 6d. Cd. 8,073.

of men are appointed, but work together in the interests of the one combine. This staff is often controlled by a manager in the oversea market, through whom every order passes to the home organisation. It is easy to realise the greater efficiency made possible oversea by this method of working; the value of personal supervision of travellers by a competent head cannot be over-estimated.

At this point it is necessary to refer to one detail practically unknown to British firms who are represented by an agent in the South African market. German combines, and many German firms, send by each mail to their agent or agent-manager a list of orders executed during the week, showing, amongst others, the following particulars:—

(*a*) Works or f.o.b. cost; and
(*b*) Price accepted by agent. } (*b*) − (*a*) = works profit.

which enables the agent to see at once from former indents (provided that costs of production have not risen in the meanwhile) by how much he can "shade" his price, if necessary, to secure a special order. Such co-operation ensures the mutual advantage of the manufacturer and his oversea representative.

Need for Co-operation.—There are British firms who, through lack of appreciation of the benefits of co-operation, seem to grudge every cheque given to the agent, and who are not anxious, apparently, to assist him at their own immediate expense to increase his turnover for them; it is not to be wondered at if such agents, in time, fail to do their best. This mutual policy of getting as much as possible for as little as possible is, of course, fatal to the interests of both parties. British manufacturers have no right to expect success in the South African market unless they are prepared to believe that their agents, importing firms, and others in a good position to judge, are fully aware of the difficulties to be found in the market, and of its most intimate needs.

Supply the Goods Wanted.—I have laid stress elsewhere upon the vital need for the manufacture by British firms of the goods to which the market is accustomed. Having made clear that the "cheap" lines are not necessarily trashy goods, but merely cheaper grades of lines in many cases already manufactured by British firms, one must repeat that the mainstay of the South African market is goods that meet the requirements of the native and "poor white" populations. In the higher qualities, purchased almost entirely by the European population of the large towns, British manufacturers have, on the whole, a position from which it would be difficult for foreign competitors to remove them. Nevertheless, their present position of security should not lead them into thinking that they are entirely unassailable in their superiority. It is common for one to hear that the British manufacturer is content with the trade in the better-class lines already being done satisfactorily by him, and that he cannot see that it would be to his advantage to gain a reputation for manufacturing cheap and inferior quality substitutes. The fact remains, however, that reputations in this market have, in the past decade, been built up by German firms through the exploitation of these same "cheap" goods, and many of such firms are perfectly capable of turning out the better-quality article as soon as it is demanded, or are already doing so. I am convinced that unless British firms make strenuous efforts to capture this "cheap" trade from Germany at this opportune moment, they will not only find that it will be secured by other countries, or that Germany herself will retain it, but they will be affording their competitors an opportunity to undermine their position in the better-class articles. The statistics of the past few years clearly show that the United Kingdom has lost trade in what may be termed the competitive articles, and is barely maintaining her percental position even in articles which have been regarded as practically British monopolies.

The Danger of Neglect.—Some British firms may find that the whole of their output can be placed satisfactorily within the United Kingdom, in Europe, or in other oversea markets, without their troubling about South Africa, whose requirements, it is true, may not be in lines of the exact quality which they now manufacture. In such case they may be justified in leaving South Africa alone; it is worth while, however, for them to consider the fact that, in allowing the South African market to be controlled increasingly by foreign suppliers of "cheap" lines, they will thus be adding to the strength of their competitors, which, in due course, may be diverted to opposing the position now held by British firms in the markets of the United Kingdom, the Continent, and elsewhere. I cannot come to any other conclusion than that, for the sake of their own security of position in the future, it is worth while now to oppose foreign competition which meets us in *any* market.

South African importers are more sympathetic towards the British manufacturer than they have been for many years. That sympathy will, however, last no longer than the success of the British manufacturer in supplying the needs of the South African market in competition with foreign factories. United States firms have put forward strong efforts through their representatives in this market to capture some of Germany's past trade. Whatever of this trade these firms can capture will strengthen them in their future dealings with South Africa, perhaps at our expense. This is, therefore, a further reason why British firms should capture as much of Germany's trade with South Africa as possible.

Catalogues and Representation.—In the Bureau established in connection with the office of H.M. Trade Commissioner there are about 1,500 catalogues of British firms on file. The bulk of these deal with machinery, although those covering smaller every-day requirements are in greater demand. There is some excuse for omitting prices, etc., from the former, but not from the latter. Yet firms constantly write: "Is there any opening for our goods in your market? Catalogues are enclosed," without prices, discounts, weights, etc.!

The extent of local demand is not, in the great majority of cases, governed so much by the article itself (on account of its being in universal use) as by its price; moreover, its price in the United Kingdom is often only a poor guide to its cost to the importer in South Africa. I venture, therefore, once again to impress upon British firms the need for furnishing H.M. Trade Commissioners with the fullest possible information in this regard. If it is necessary, by all means produce special oversea catalogues. If the trade is worth getting it is worth trouble; if the trouble and expense are too much for the British firm, the foreign firms thinks differently and profits accordingly.

One is glad to say that British firms are becoming more alive to the need for representation, and are finding the benefit. One could detail cases, from actual experience, in which British firms have refused to take official advice on this question, and have emphasised their intention of trading direct or through London export houses. In not a few cases, however, as a result of the energy and activity of prospective agents whose interest I have aroused, orders have been sent to the United Kingdom, and have proved to the firms concerned that direct representation is practicable and satisfactory. Consequently, the United Kingdom firms have abandoned their opposition to direct representation, have appointed an agent at my suggestion, and have expressed themselves highly satisfied with the result.

I want to emphasise the advisability of British firms keeping H.M. Trade Commissioner posted both as to the appointment of South African representatives, and as to any change they may make in their representation.

(To be continued.)

BATTERY EXCHANGE SYSTEM FOR ELECTRIC VEHICLES.

One of the papers read at the annual convention of the Electric Vehicle Association of America, last month, dealt with the Hartford Electric Light Co.'s experience with the battery exchange system of commercial vehicles.

The author, Mr. W. M. Thayer, mentions that the company's battery service originated with a circular letter offering to furnish such service for G.V. trucks for any mileage, on which the price would be based. The customer was to be relieved from any responsibility for care of batteries.

The first car purchased for operation on this system was started in June, 1912, and all cars previously sold were changed over to the service as rapidly as possible. In June, 1915, 64 trucks were in use, travelling an average of 47,615 miles a month.

The customer purchases trucks without batteries; the company buys the batteries, charges them, and installs them in the trucks. The company's equipment consists of batteries, the means for charging them, and the apparatus for placing them on customers' trucks.

The odometers on the trucks, with cradles for extra batteries, are also part of the company's equipment. The service consists of charging batteries in cars at night and charging batteries out of cars. The former is done at the garage of the Commercial Electric Co. from 11 p.m. to 7 a.m., a rotary converter and motor generator being installed there. Separate batteries are handled at State Street station, where 31 sets of charging equipment are installed, each comprising an ammeter, Sangamo amp.-hour meter, circuit-breaker, and switch. Edison batteries of standard size and G.V. trucks, fitted with Universal cradles, are used exclusively on the service.

The cradle is an underslung battery container held by four hooks, which is removed from the vehicle by placing it over a hydraulic lift (with a 10 in. travel), a Cowan truck being first run on to the lift platform, so that the battery can be transported on it to the charging room.

Two hydraulic outfits are provided for changing batteries, and the complete exchange of a battery is made in three minutes or less.

No instruments are used on the cars except odometers. All battery charging is based on the mileage covered, with allowance for road conditions. When a battery is removed from a car the odometer reading is taken. The previous reading gives the miles covered, and a slip is placed on the battery showing this distance. The man who places the batteries on charge uses this distance as the basis, multiplying it by a certain constant, depending on road condition, size of truck, etc. The Sangamo meter is set at the number of ampere hours required and runs back to zero, when the circuit-breaker cuts it out.

The voltage of individual cells is followed during the charging and serves as a check on the ampere-hour meter.

The Sangamo meter is practical and accurate, and is certain to take the battery off charge before excessive charging occurs. Batteries are cleaned with live steam at a pressure of 10 or 15 lb.

Data are given showing that the introduction of battery service has tended to increase the mileage covered.

In June last there were 64 cars and 89 batteries in use, ratio 1.4 per truck. In December, 1914, cars on the road represented 1,432 car days, and 1,284 battery exchanges were made, or 90 per cent. of the cars changed batteries every day; for June, 1915, the figures were 1,594 car days, 988 exchanges, or 64 per cent. of cars changed batteries every day.

The power used is measured by wattmeters, and includes all losses in transformation and stepping down.

For December, 1914, the total energy consumed was 57,856 KW.-hours, the mileage covered 40,787, the average energy used, per mile, 1,418 watt-hours.

For June, 1915, the total energy consumed was 50,414 KW.-hours, the total mileage covered 47,615, the average energy used, per mile, 1,058 watt-hours.

The Edison batteries used on the "service" are in some ways subjected to very hard usage. The total number of cells in use at the end of the first period of three years was 5,094, and their service was the equivalent of 113,850 cell months. Seventy-six cells have been returned to the factory for repairs in these three years—44 on account of leaks or broken seams, and the balance of 32 cells for other causes, such as failure to charge up or broken terminals.

Data regarding the operating costs for the "service" are included. These are credited to *operating labour, i.e.*, exchange of batteries, filling, charging, changing solution, etc.; *operating material, i.e.*, distilled water, solution and other battery material; *repair labour, i.e.*, actual battery repairs; *repair material, i.e.*, parts for battery repairs or repairs at factory; *repair service apparatus, i.e.*, labour and material for repairs to charging sets, and extra apparatus required for handling batteries.

	1st yr. Dols.	2nd yr. Dols.	3rd yr. Dols.	3-year total. Dols.
Total operating items ...	3,847	13,505	14,352	31,705
Income	5,543	18,559	26,559	50,662
Per cell per month.				
Total operating items ...	.2885	.3102	.2518	.2793
Income	.4158	.4263	.4661	.4449
Per car per month.				
Total operating items ...	21.61	25.92	20.89	22.87
Income	31.14	35.62	38.65	36.55
Per average mile.				
Total operating items ...	.032	.036	.028	.032
Income	.046	.053	.054	.051

A development of the system foreshadowed is an arrangement with central stations in surrounding towns, so that trucks may make long trips and get boosts when necessary, the charge being made to the company furnishing battery service and a proportion charged to the customer.

WAR ITEMS.

American Electrical Export Trade.—The New York "Electrical World," in a recent editorial on the above subject, describes the figures for American electrical exports as being disappointing, and asks why they are not better. Our contemporary continues thus:—"On the surface it would seem that electrical export trade should have had some kind of boom, unless it has been affected adversely by world conditions cutting down all international trade other than that in weapons of destruction. But the neutral markets of the earth have been opened to us as never before, and our competitors who still enjoy the freedom of the seas are seriously preoccupied. It is generally understood, for example, that in England many electrical factories are busy on munitions of war; and, if that is the case, they cannot be turning out electrical goods as well. Indeed, England itself would be on these terms an excellent source of consumption for our electrical goods and have little left for export. This must apply with even greater force to all central Europe, including France, Belgium and Italy, as furnishers to the markets of, say, the Far East and South America. But when one line of electrical goods alone—insulated wires and cables—accounts for 650,000 dol. gain in the seven months, other branches would not appear to be keeping pace, although some of them bore marks of greater activity. Perhaps we are not going after the foreign trade possibilities as we should; perhaps we don't know how, and have yet the lesson to learn. If so. now is the time to learn it before our European competitors turn again to the arts of peace and with the energy of desperation try to regain lost ground with goods at any old price. The figures of the Bureau of Commerce do not reveal destinations, but it must be true that South America is looking this way and expects to be cultivated by various commercial attentions."

After the War: Two Views.—At the annual general meeting of the Phœnix Steelworks, Herr Beukenberg, the managing director, in the course of a long statement on the position of the company, made the following remarks:—

What the conditions will be like after the war cannot be conjectured at present. There is, however, no cause for great anxiety, although it is certain that our capital and that of many countries which are our principal selling markets is being weakened. The danger also exists that North America, owing to enormous profits her iron industry is now reaping, will be financially exceedingly strong after the war, and will therefore be able to compete with us accordingly in the world's markets. On the other hand, we have seen that neither North America nor England has succeeded in injuring us with our foreign customers during the war. In any case, in Germany itself there will be much work for our industry after the war which will allow of no postponement, such as the repairing of permanent-way material and rolling-stock, the building of merchant vessels, and the reconstruction of the devastated districts. If the war ends as happily as we hope, the spirit of enterprise will also revive in the building trade.

The following advertisement is translated from the "Kölnische Zeitung":—

Business with Enemy Countries after the War.—After the conclusion of peace many German firms will presumably experience difficulties in creating or renewing business relations with enemy countries. Such difficulties may be minimised or removed *via* Holland, and an experienced Rotterdam merchant, not without means (formerly many years resident in Germany), places his services at disposal. He also undertakes to buy Dutch goods of which the export is permitted.

Then follows the address of an advertising agent in Düsseldorf, to whom replies are to be sent.—"Ironmonger."

Electricity Works and Depleted Staffs.—Rather late in the day, but better late than never, the Minister of Munitions has had his attention drawn to the danger that the country will run if, owing to enlistment, its electricity supply and gas works are left understaffed. The said Minister finds that the work of many munition factories is being imperilled by the difficulties now being experienced by the electrical supply companies and gas companies, which provide them with power and light, in retaining a sufficient staff for their immediate needs. The Minister desires to point out that such companies are engaged upon work of vital importance, and that the removal of their employés even to munition work may frequently have the effect of prejudicing the output of munitions of war. He would at the same time invite employers to assist him in the matter by refraining from attracting labour from these essential undertakings.

Those who have known how real the difficulty and danger have been in some areas for some time past will wonder why the attention of the Minister of Munitions was not drawn to the matter earlier.

Llandudno U.D.C. has not granted Mr. J. E. Evans, second assistant at the electricity works, permission to volunteer for munition work, having regard to the number of men who have already left the department at the call of the State.

Interesting figures concerning men enlisting from various departments of Blackpool Corporation (those still eligible and the number who can be spared), were presented to the General Purposes Committee on November 4th. The Tramways Department has contributed the largest number of men—64—while 37 have gone from the Electricity Department. The Tramways Department can still spare 20, and the Electricity 6.

Criticising the action of the Dundee Town Council in passing a resolution calling for the enlistment of eligible employés, a correspondent asks:—"Have they tried to foresee the effect, as a contribution to war needs, of allowing the skilled staff of the electrical department to enlist? At present a good round dozen of big establishments on shells, khaki, and Admiralty materials, not to speak of sand-bags, would come to a dead stop if a breakdown occurred in this department. The mere lighting consumer or the user of the services of almost any other public department must take his war risks, but the electrical department, with its costly plant, its specially trained engineers, and its commitment to pressing war services is not for playing tricks with, and is even more vital than many controlled establishments whose employés dare not enlist or transfer their services."

The Whitby U.D. Council has passed a resolution deciding to pay the electrical engineer (Mr. J. Piggott) 10s. per week extra during the period of the war, or until the Council determine otherwise, on his undertaking to do jointing and to take one alternate Sunday shift at the power station when necessary. This matter originally rose by Mr. Piggott offering to do the extra work necessitated through a man earning £2 per week having left the works.

Limitation of Output, in War and in Peace.—"Limitation of output as practised by some trade unionists has recently attracted a large amount of attention. It is argued in some quarters that this practice, although it cannot be too strongly deprecated during this period of national necessity, may be very right and proper in normal times. If it is wrong to restrict output while we are at war, it cannot be right to do so in times of peace. In neither case can we afford to decrease our efficiency as manufacturers. When we are at war we must have munitions as quickly as possible, so as to keep our armies properly equipped; in times of peace we require the largest possible output from our machines, so that we may combat our competitors' efforts to supplant us in the world's markets. How any sane person can hope to capture German trade if our workmen are content to receive a day's pay for less than a fair day's work passes one's understanding. We are well equipped by nature for

obtaining our fair share of the world's trade. We have good and abundant raw materials and unequalled shipping facilities. The distance between mine, furnace, mill, works, and port is less in this country than in that of any serious competitor. We must supplement these natural advantages by the encouragement of enterprise, industrial organisation, and manufacturing skill. So by deserving success we may obtain it."—"Alfred Herbert's Monthly Review."

Provisional Orders in War Time.—The Board of Trade hereby give notice to parties contemplating the promotion of Provisional Orders in respect of electric lighting, gas and water, piers and harbours, and tramways, that for the duration of the war they will not be prepared to entertain such applications except in cases in which they are satisfied that extreme urgency exists.

European Electrical Companies in War Time.—The following is the table of European company dividends for the last two years, to which reference is made in our leading columns to-day:—

	1913 or 1913-14.	1914 or 1914-15.
Officine Elettriche Genovesi, Genoa	10	10
Società Meridionale di Elettricità, Naples	4	5.2
"Dinamo," Società Italiana, Milan	3	4
Società Idroelettrica Ligure, Milan	8	8
Società Adriatica di Elettricità, Venice	7	7
Società Elettrica Riviera di Ponente Ing. Negri, Milan	6	6
Compania Sevillana de Electricidad, Seville	8	8
Compagnies Réunies Gaz et Electricité, Lisbon	7½	*
Strassburg Electricity Works	11	11
Rheinfelden Power Transmission Works	8	8
German Transmarine Electricity Works, Berlin and Buenos Ayres	11	10
Abo Electricity Works (Finland), Berlin	7	—
Silesian Electricity & Gas Works, Breslau	10	10
Mark Electricity Works, Berlin	5½	3½
Upper Rhenish Power Works, Mulheim	6	—
Konigsburg (Prussia) Electricity Works and Tramways	8	8
Main Power Works, Hochst	5	5
Lech Electricity Works, Augsburg	7½	*
Thuringia Electricity Supply Co., Gotha	4½	4½
Lower Elbe Electricity Works, Altona	4	5
Electricity Supply Co. (Investments), Berlin	12	10
Bavarian Electricity Supply Co., Bayreuth	—	4
Petrograd Electric Lighting Co. of 1886	8	8
"Electrica," Roumanian Lahmeyer Co., Bucharest	9	9
Compagnie Générale d'Energie Electrique, Paris	5	—
Central Swiss Power Works, Lucerne	5	5
Unione Italiana Tramways Elettrici, Genoa	9½	8½
Berlin Elevated & Underground Railway	6	4½
Silesian Secondary Railways, Kattowitz	2½	2½
Bitterfeld Electrochemical Works	10	10
Brandenburg Carbide & Electricity Works, Berlin	—	7
Bavarian Nitrogen Works, Munich	8	*
Brown, Boveri & Co., Baden	5	5
Felten & Guilleaume, Mulheim	8	8
"Motor" Applied Electricity Co., Baden	7	7
"Watt" Co. for Electrical Undertakings, Glarus	6½	5½
Société Centrale pour l'Industrie Electrique, Paris	6	—
Società per lo Sviluppo delle Imprese Elettriche, Milan	7	7
Trustee Bank for the Electrical Industry, Berlin	4	4
Electro-Trustee Bank, Hamburg	5½	5½
Electricity Co. (late Lahmeyer), Frankfort	7	6

* Dividend not yet announced.

Australian Government and its Contractors.—With reference to the statement reproduced in our last issue from the "Melbourne Age," in which allusion was made to the position of Messrs. Falk, Stadelmann & Co., Ltd., we have received from the firm in London the following copy of a cable dispatched by them on October 30th addressed to Mr. Hughes, the Attorney-General:—"Attorney-General Hughes, Melbourne.—If statement made by you is accurately reported in "Argus," September 17th, saying this company is 'almost entirely owned by Germans,' that it is 'masquerading under the guise of British registration,' or 'dominated by German influence,' we respectfully state that evidence produced to High Commissioner, in London, conclusively proves that none of these conditions apply to us.—Falk Stadelmann."

A Fresh German Price Advance.—The German syndicate of makers of weak current apparatus has raised the prices of light electrical engineering apparatus and accessories so that these now stand at 30 per cent. in excess of those prevailing in the pre-war period. As the present increase does not cover the actual cost of production in many cases, the syndicate reserves its right of further advancing the list quotations in any particular case.

Miners on National Service.—The Home Office has issued a notice to coal miners and to surface workers, including electricians and fitters, informing them that the country depends upon them for the success of its efforts no less than upon the men who are serving with the Forces. Those who offer themselves as recruits will only be accepted on condition that they go back to work in the mine until they are called upon. Armlets will be provided. Without coal, victory is impossible.

German Activity in Neutral Countries.—The "Standard" special correspondent in Switzerland says that a characteristic example of pushing German business enterprise which aims at securing financial and, indirectly, political influence in neutral countries, has just been given in the Swiss canton of Berne. With a view to obtaining the contract for the construction of the new electric railway from Haute-Argovie to Seeland, the Allgemeine Elektricitäts Gesellschaft, of Berlin, bought shares in the Swiss company formed to build and work the line to the extent of £3,750, of which £880 had been paid up. But the Swiss Government, on learning of the transaction, intervened, and compelled the directors of the Haute-Argovie company to cancel the sale of shares to the Berlin concern and to refund the amount already paid, with interest at 6 per cent., to the German purchasers. The Swiss Government now makes it known that this step was taken "in the interests of Swiss industry."

Australia and German Trade.—Reuter's agent at Melbourne quotes Mr. Hughes, the Federal Prime Minister, as saying to a deputation that he was wholeheartedly in favour of doing everything in his power to injure Germany, and that the Ministry was considering the question of removing from the register all German trade names.

Aluminium Exports Prohibited.—By an amendment to the Proclamation of July 28th, it is now declared that the exportation of "aluminium, manufactures of aluminium, and alloys of aluminium," which is already prohibited to all destinations abroad other than British possessions and Protectorates, should be prohibited to all destinations.

Electricity Works and War Badges.—The Stretford D.C. has received 19 war badges for the engineering staff at the generating station.

Controlled Establishments.—The number of "controlled" establishments is now 1,679.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Tramway Differential Gears.

For some months past Mr. R. H. Wilkinson, manager of the Huddersfield Corporation Tramways, has been operating 11 cars fitted with differential driving gears, with a view to testing whether or not rail corrugation is caused by the skidding and slipping of wheels of unequal diameter; the effect of such a drive on energy consumption and tire life is also being watched. The cars are exclusively run on a route which was subject to corrugation trouble, but on which the corrugations were ground out before

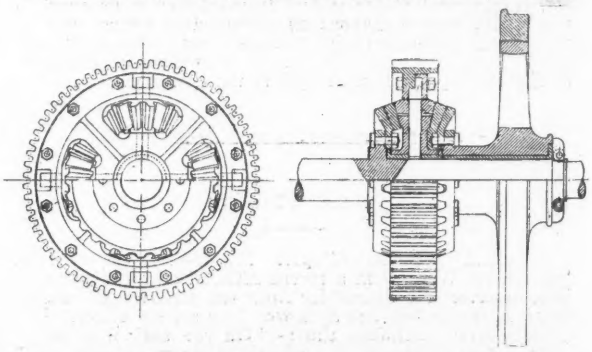


Fig. 1.—Differential Gear Fitted to Huddersfield Cars.

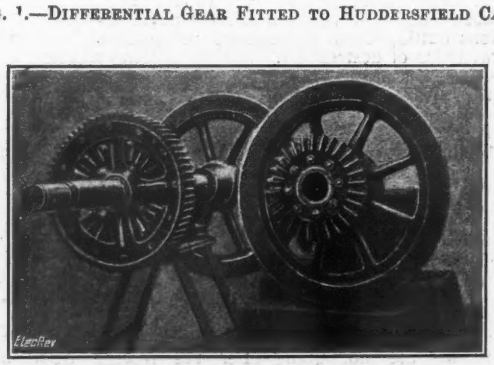


Fig. 2.—Tramway Differential Gear Dismantled.

running the special cars. The differential gear wheel replaces the ordinary gear wheel, one half of the differential bevel being bolted to a collar forged on the axle, while the other half is bolted to an extension of the hub of the near wheel, which is loose on the axle and fitted with a gun-metal bush. The gearing is of cast steel

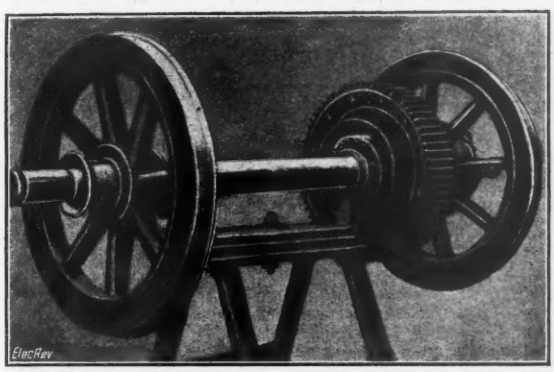


Fig. 3.—Tramway Axle fitted with Differential Gear.

with machine-cut teeth, and is bushed with gun-metal; a thrust collar is provided outside the hub of the car wheel, removal of which enables the gear to be dismantled.

Inspection Lamp for Shell Work.

To facilitate the examination of shell interiors during construction the British Thomson-Houston Co., Ltd., of Mazda House, 77, Upper Thames Street, E.C., have brought out the workmanlike hand lamp shown in fig. 4.

A stout brass wire guard with top and bottom plates forms a "squirrel cage" accommodating a tubular lamp of size not exceed-

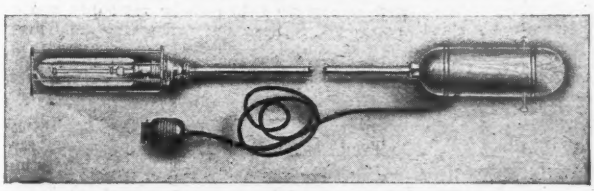


Fig. 4.—Inspection Lamp for Shell Work.

ing 4⅞ in. by 1½ in. diameter. This guard (which can be removed if required) is carried in the usual manner by a bayonet lamp-holder, which is mounted on a brass carrier-rod. At the outer end of the latter is a boxwood handle, incorporated with which is a push-bar switch. The lamp, which is supplied wired with 12 ft. of 35/40 workshop flex to a cocus adapter for connecting to existing electric light installation, is built to withstand hard workshop service.

A very important point is that when an ordinary electric light supply is not available, the new inspection lamp, equipped with one of the many types of Mazda miniature bulbs, can be worked from a low-voltage accumulator or even dry cells. It can therefore be used effectively in every munitions workshop.

New Cantie Switch.

The Cantie Switch Co., Ltd., of 67, Mount Street, Nottingham, has introduced a new pattern of single-pole mining switch, shown in fig. 5. This consists of a robust and simple switch mechanism fixed in a porcelain base, which is mounted in the interior of a circular iron case. The switch has a long, quick break and quick

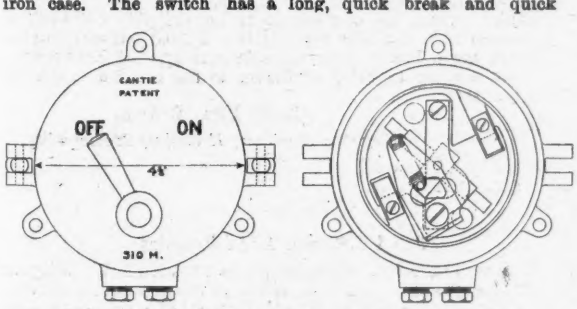


Fig. 5.—Cantie Mining Switch.

make, and is positive in action; the controlling spring is subject to slight extension only. The cover slides into the base, and the joint provides ample cooling surface for hot or burning gases; the cover is secured by a hinged bolt on either side, and lifts off with the handle, exposing the interior mechanism. The design is an exceedingly compact one, and is also embodied in the form of a high-voltage, quick-break switch, with a flat brass cover on a 3½-in. diameter porcelain base, the handle projecting through the cover, this pattern being a good mechanical substitute for the large types of tumbler switch.

Anti-Zep Shades.

The Edison & Swan United Electric Light Co., Ltd., of Ponder's End, Middlesex, have issued a new leaflet, S.S. 3,121, illustrating and describing their new Ediswan anti-Zep shades, which

Fig. 6.—Ediswan Anti-Zep Shade.

have been specially constructed to meet the shaded light regulations which are being enforced by the local authorities.

Three types of shades are listed in dark green sateen, one being a conic pendant shape, and another, which we illustrate in fig. 6, of shell shape.

CORRESPONDENCE.

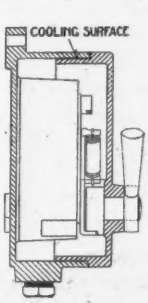
Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The B.E.A.M.A. and Foreign Firms.

I have before me a photograph showing parts of shells picked up in Flanders, from the identification marks on which their origin is traceable to two of the largest electrical manufacturing firms in Germany. These firms still have their subsidiary or associated companies operating in this country to the detriment of our own people, and it was my first thought that some measure should be taken to give as wide publicity to this fact as possible, but—a further thought forces itself on one's mind. How many British electrical firms are there at present in this country who are manufacturing munitions? Do we consider it criminal on their part in coming to their country's aid? Likewise is not the possibility of the finding of a shell made by a British company in the German trenches productive of equal discomfiture to its associates (if any remain) in enemy territory?

The answers to these questions apply equally to both sides when put from their own point of view, hence the futility of holding up to odium and disrepute what we in ourselves would praise.

It is well known that we on our part grant greater privileges and freedom to foreigners in our midst than we receive from them in their country, and it is due more to this inequality of treatment that our own people suffer than by the patriotism of the enemy.



While British firms and their associates ceased to enjoy all privileges in Germany almost from the commencement of the war, we have here German subsidiaries who have never at any time manufactured goods in this country, merely serving as distributors of foreign made articles, still able to carry on their business. Such firms under present conditions would receive but little support from patriotic Britons were it not for the fact that their identity is too often obscured by their English titles.

I would, therefore, suggest for the serious consideration of the B.E.A.M.A. and all other manufacturing and trading associations the necessity of immediately bringing about such alterations in company law as would disclose the origin and the extent of foreign financial interest in such concerns by enacting:—

1. That the use of the word *British* be not allowed except to all-British concerns.

2. That companies of foreign origin having 50 per cent. or more of their shares held by non-British subjects be required to

register under the full name and title of the foreign promoting company; initial letters not being permitted.

3. That companies originating in English-speaking parts of the world, not within the British Empire, and having financial qualifications as above be required to use the full name and title of the parent or promoting company, with the addition of the words (Great Britain) Ltd.

4. That all alien companies, whether subsidiaries of existing concerns or newly formed, be required to frame their titles according to a specific standard which would serve as an indication that the predominant interests were foreign, viz.:—

Allgemeine Elektricitäts Gesellschaft (Great Britain), Ltd.

The Constantinople Electrical Co. (Great Britain), Ltd.

No doubt many difficulties will present themselves in applying the above principles to individuals acting for themselves or as agents, but surely these are not insuperable.

The British Empire has been the happy hunting-ground of all and sundry, and it is time we reserved to ourselves benefits proportionate to the initiative and responsibilities of our own people in building up this magnificent structure; to say nothing of the sacrifice in blood and money that is now being made to support and maintain it.

C. W. Crosbie.

Bedford, *November 4th*, 1915.

P.S.—Since writing the above your issue of 5th inst. is to hand from which I note that the above principles are being acted upon in Australia and by a few of our municipalities at home; nevertheless, it is necessary that they should be embodied in the "Law of the Land."

The A.E.G. Meeting.

May I be allowed to add a few further remarks to this correspondence, which I initiated, and which seems now to be arousing some real interest. I have reason to believe that many of the articles which the Electrical Co. are factoring are obtained from manufacturers on the basis of pre-war contracts. Hence (the Electrical Co. being in the eyes of the law a British Company), no single manufacturer could refuse to supply under the terms of a pre-war contract without running the risk of an action for breach of contract. There appear to me, therefore, only two alternatives: (1) for the manufacturers who made pre-war contracts with the Electrical Co. to combine to repudiate these contracts, or (2) for the retail trade to refuse to purchase from the Electrical Co. It is for the B.E.A.M.A. and the T.L.A. to consider the first alternative. Possibly certain of their members would be willing to bring pressure to bear on their councils to act in a collective manner. It must always be remembered, however, that any such action, however patriotic, would be to the detriment of the individual and collective manufacturers' sales! As regards the second alternative, there is no doubt that the contractors are more guilty from a patriotic standpoint than the manufacturers, because they are not bound by contract to purchase.

Now the letters of Messrs. E. P. Allam & Co. show the right spirit, and I suggest to this patriotic firm of contractors that they call a meeting of other contractors to consider the whole question. In order that those who call or attend the meeting should not be liable to prosecution for conspiracy in restraint of trade, it would be necessary that the subject should be treated in a general manner, and that the name of the Electrical Co. be omitted altogether from the proceedings. Those who use the protection of the law for unpatriotic purposes must expect those who fight them to be equally cunning.

Inquisition.

November 6th, 1915.

My attention has been called to the letter in your issue of the 29th ult., signed "Anti-Humbug," and I very much regret your correspondent did not think it desirable to append his own name.

He seems to think it patriotic to sling mud in every direction without, apparently, the slightest grounds for his statements. I notice, with pleasure, that you have already replied to the unwarranted attack upon the Technical Press, and I should like to say, upon behalf of the Electrical Contractors' Association, that there is not the slightest ground for any of the statements made. The E.C.A. do not regard trading with the enemy with apathy. On the contrary, this is a matter which has received drastic treatment at various meetings. There is not the slightest alien influence at work within the Association, nor is there anything to fear of a like nature from outside.

Your correspondent states that on information he has received, "it is as much as the Association's existence is worth to interfere with, or tackle, the subject." What the meaning of this can be I am at a loss to understand.

H. Marryat,

Ten Years Member of Council E.C.A.

London, E.C., *November 3rd*, 1915

Decimal Coinage and the Metric System.

I have followed your articles upon this matter with great interest, and the field covered has been so wide, that I am afraid there is very little I can add to what has been said by your correspondents and yourselves. To me, however, it appears that if the desired object is to be attained, very substantial and united effort is necessary; any isolated attempt will be useless.

I am strongly of opinion that the adoption of the Continental systems in this country would be of considerable benefit and assistance to our overseas trade in general, and would be a step in the right direction if we are to grapple successfully with the German competition in foreign markets, which will be fiercer than ever after the war. A nation possessing such an effete system of weights and measures as ours must naturally be at considerable disadvantage in its commercial aspirations alongside of its more up-to-date rivals.

In so far as coinage is concerned, I think your suggestion that all catalogues for foreign trade should quote in terms of francs, as an alternative to our own coinage, especially worthy of notice, as it should surmount to a large extent the difficulty of quoting in local coinage, so vulnerable to fluctuation. The equivalent value of the franc is generally known in all countries, but this much can hardly be said of any unit of our own coinage.

I am very doubtful, however, whether the Government will take any steps towards the universal adoption of the metric systems, unless the movement is supported by all the leading and influential bodies of public service throughout the country. To effect this, a vigorous campaign—such as you have originated—must be conducted by the various technical journals interested. Would it not be well to take the matter up with the various electrical and allied engineering manufacturers and other associations, with a view to inducing them to agree *en bloc* to support the adoption of the modern system? If responsible bodies such as these showed their emphatic approval of the proposal, I think it would have far-reaching consequences. I suggest also that the London Chamber of Commerce be approached, amongst others, with a view to obtaining their support and united effort in the matter.

Aurora Borealis.

[The Chambers of Commerce, not only of London, but of the Empire, have strongly advocated the compulsory adoption of decimal coinage and the metric system for more than 20 years.—Eds. Elec. Rev.]

A Noisy Motor-Generator.

Could any reader tell me the cause of the following trouble which I have with a motor-generator?

The A.C. motor is a single-phase slip-ring, 400-volt, 50-period 1,500-rev. ball-bearing machine. The stator is wound three-phase, star connected. The rotor is a three-phase wound rotor, and is also star connected.

The trouble is a surging noise which can be heard all over the building. I have tried to remedy it by putting masculite under the bed, but this has no effect. I have tested the rings, and find when running they are completely short-circuited. The set has been tested for balance and found quite correct.

Troubled.

November 8th, 1915.

Trade with Russia.

With this letter we have the honour to ask you to note in your esteemed journal for the information of your readers that our company, who are concessionaires of electric lighting stations in Pawlowsk Uman, and Kamenetz Podolsk, and of tramways in Elizabethgrad and Uman, have opened at the present time a branch for the re-sale of electrical machines and apparatus, and insulating materials, and also of steam and naphtha engines and water-turbines, and desire to enter into relations with first-class factories in your country producing these goods, with the view of becoming their agents in Russia.

At the same time we have the honour of informing you that our company belongs to the Russian and French Bank, and we have full possibility to offer for all our engagements the complete guarantee of this bank.

Russian Society for Electrical Enterprises, Ltd.

Petrograd, *October* 12/25, 1915.

An Invitation from South Africa.

Now that the German houses have ceased to exist here, I shall be pleased to hear from electrical supply houses that are not represented in this country with a view to assisting in the establishment of an all-British market for South Africa.

Catalogues, samples, best export terms, shipping weights and dimensions will be gladly received, and I trust you will be able to spare me a line in your valuable weekly, the Electrical Review, in order to bring my desires to the notice of our home manufacturers.

T. H. Alex. Brown,

Electrical Engineer, Heidelberg Municipality.

Heidelberg, Transvaal,
October 11th, 1915.

The I.E.E. and Alien Enemies.

It seems to me that your correspondent "A.M.I.E.E." is trying to confuse the issues when he makes out that we should not be honouring our "Scraps of Paper" if we asked members of alien enemy origin to withdraw from the Institution of Electrical Engineers. I have been associated with the I.E.E. for 10 years, and it was only last week that I gathered from "A.M.I.E.E.'s" letter that naturalisation papers carried the right of membership of the I.E.E., and that expulsion from the I.E.E. carried with it a denial of British citizenship.

What are the facts regarding German residents in Belgium, France and Russia? Wherever the German armies have penetrated, the inhabitants have discovered to their sorrow that the peaceful, decent German who had lived beside them for years, and whom they had come to regard as one of themselves, had been planted there for a definite purpose. We have not had to undergo that kind of awakening because there is a British Navy, but does "A.M.I.E.E." really believe that German organisation, which has silently and thoroughly prepared for 40 years to dominate the world, has really forgotten to plant emissaries in these islands? Germany's advance guard in this country we may be sure are naturalised British subjects, a trifling formality to a German, for alien enemies would be interned immediately on the declaration of war by any prudent Government, and so would be of no value to Germany.

Naturalisation papers, business interest, and every other device that could disarm suspicion, have been practised by those who have betrayed their Belgian, French and Russian fellow-citizens, and with this record of Germany's duplicity before us, the Council of the I.E.E. would be fools indeed if they accepted members of German origin at their own valuation.

Even if there were a few decent Germans among them, they should be the last to complain at the loss of a few privileges because the present state of affairs has been brought by the act of their own people. Natural-born British subjects are cheerfully submitting to galling restrictions for the safety of their country, and if the Germans who have been naturalised have the good of their adopted country at heart, they should be ready to recognise that every precaution must be taken against an unscrupulous foe.

Perhaps if the German blight were removed from the management of the affairs of the I.E.E., there would be an awakening from the criminal policy of "do nothing" which has distinguished the I.E.E. for the past few years, at the very time, too, when the electrical industry was fighting for its existence against unfair German competition.

Another Station Engineer.

Our correspondent of last week, "A Member" of the Junior Carlton Club, informs us that the Royal Automobile Club, which is the largest in England, if not in the world, and of which he is also a member, has also through a notice issued by the Committee requested members who, though naturalised, are of German, Austrian, or Turkish birth, to abstain from using the Club during the war.—Eds. Elec. Rev.

A Contractor's Complaint.

Reading the article in your issue of October 29th, on "Apprenticeship in the Electrical Contracting Industry," has led me to venture into your columns with a few remarks on this same industry. Does it not suggest itself to some of these existing "Associations" of one kind and another in the electrical world, that the first needed reform is to improve the lot of the contractor? When will some such association be formed whose business it will be to see that electrical contracting is kept in the hands of men trained in electrical work, who have served their apprenticeship and worked as charge hands on responsible works, before they are allowed to foist themselves on the public as "electrical engineers and contractors? The existing Electrical Contractors' Associations are all very well in their own localities, but they have failed to stop wholesale firms from giving trade terms to ironmongers, cycle agents, and, in fact, any kind of shop-keeper who chooses to write for their lists; why should ironmongers be allowed full trade terms off lamps, &c., when they have never devoted a minute of their lives to the study of electricity? Why should not an an electrician be entitled to get trade terms if he wants to buy a frying-pan or a gridiron?

Since the introduction of metal-filament lamps there is an interesting and productive field for the energies of the contractor in the carrying-out of village lighting schemes. This class of work is gradually being snapped up by cycle agents, thanks to the business enterprise of a certain wholesale house, who send their representative to give any necessary technical information that the cycle agent wants, with the result that the latter usually blossoms forth in the course of a few weeks as an "Electrical Engineer and Contractor" in competition with the man who has spent time and money and energy in learning his business and accumulating experience solely in electrical work; and the public usually support the cheap man (I am writing of my own experiences "somewhere in the North of Ireland").

When the Electrical Contractors' Associations are able to dictate to the big supply houses they will have justified their existence and improved the condition of their fellow contractors.

J. S. L.

LEGAL.

Widow's Compensation Claim.

In the King's Bench Division, the Lord Chief Justice and a special jury heard an action by the widow of Arthur Blach, an electrician, against the Port of London Authority, for damages for the death of her husband, which, she alleged, was caused through the defendants' negligence. It was stated that the deceased man was engaged in the electric lighting of a vessel which was being re-constructed, and while on his way home on Christmas Eve last he lost his way in the fog and fell in the defendants' dry dock, which, the plaintiff alleged, should have been fenced round. The defendants repudiated negligence, stating that Blach should have displayed more care when using the side of the dock on such an occasion as the one in question.—The jury disagreed, and were discharged.

An Electrical Company Prosecuted.

Charges of exporting prohibited goods were heard at Woolwich the other day, when the Western Electric Co, Ltd., were charged with sending telephone parts to Woolwich Post Office for export to Norway. It appeared that a letter addressed to a firm in Christiania was opened by the Censor and led to an inquiry. It was alleged that the defendants sent the goods by parcel post to avoid the delay of getting an export licence. The case was adjourned.—*Daily Mail.*

Locker-Lampson and Another *v.* Isaacs and Another.

In the Chancery Division on Friday last this action was mentioned. Mr. Gore-Browne, K.C., moved for the defendants to stay the action on the ground that the plaintiffs were not proper plaintiffs, and that the company ought to be the plaintiff, if anybody. The defendants had put in affidavits in support of the allegation that the action was frivolous and vexatious.

It was arranged that the motions should stand over for three weeks.

OUR LEGAL QUERY COLUMN.

"Scotland" writes:—"The following is an abstract question which will probably interest your readers. 'A' is a consumer of electric light whose premises have been destroyed by fire, the origin of which has not been discovered. The meters, cut-outs, and service lines on 'A's' premises have been entirely destroyed, and the undertakers are claiming against 'A' for the value of their property. Although the premises are fully insured, can 'A' refuse to pay the undertakers on the ground that he is not liable? The Electric Lighting Acts do not deal specifically with the point, nor yet does the undertaker's provisional order. Can the undertakers, therefore, claim against 'A' for the value of their property?"

*** Everything appears to depend upon the terms of the agreement between the undertakers and the consumer. If 'A' is the hirer of the meters, &c., and if he is subject to liability to deliver them up in good repair at the end of the hiring, he must reinstate or pay damages. If, on the other hand, he is a mere bailee, it is conceived that he would not be liable. In Halsbury's "Laws of England" it is stated that "apart from special contract, a custodian is not responsible to the owner of the chattel entrusted to him in case of its destruction." Inasmuch as the meters and cut-outs are on the consumer's premises as well for the benefit of the consumer as the undertakers, it is probable that the law will regard him for this purpose as a custodian.

BUSINESS NOTES.

The Increased Postal Charges.—The attention of our readers is called to the fact that consequent upon the recent increase in the Postal charges for newspapers, the subscription rates for the Electrical Review for Great Britain and Canada will, until further notice, be raised to £1 1s. 8d. and £1 3s 10d. respectively.

Liquidation. — "Dac" Accumulator Syndicate, Ltd.—A meeting is to be held at 61 and 62, Lincoln's Inn Fields, W.C., on December 6th, to hear an account of the winding up from the liquidator, Mr. H. C. Bound.

Bankruptcy Proceedings.—Harry Arthur West, electrical engineer, late of 73, Old Dover Road, Blackheath.—This public examination was held on Tuesday, before Mr. Registrar Brougham, at the London Bankruptcy Court. The accounts showed liabilities £654, and assets nil. In reply to questions put by Mr. J. B. Knight, who attended as Official Receiver, the debtor stated that for the past 37 years he had been employed by an insurance company, his present salary being £370 per annum. In 1910, with a view to setting his son up in business, he purchased the business of an electrical engineer carried on at 55, Old Dover Road, Blackheath, under the style of F. Clayton. The purchase price was £175, which he borrowed and still owed to a Mr. Lister. He removed the business to No. 73 in the same road, and put in his son as manager, but the trading was not successful, and he eventually closed the business in March, 1914. His son was not a good business man, and he neglected the business, with the result that he, bankrupt, was involved in further indebtedness. He had borrowed a considerable amount of money from Mr. Lister, who had obtained judgment against him for £340, and there were other loans for which he was liable, amounting to between £200 and £300. The whole of the money was borrowed for the purpose of the business.

He estimated his loss on the business at considerably more than £350. In July, 1914, he wanted further money, and told Mr. Lister that his son was entitled to an interest under a will which would eventually be worth £1,000 when his son was 25 years of age. He did not tell Mr. Lister that the interest was mortgaged to the Norwich Union Co. for £300, but that was an oversight on his part. Eventually Mr. Lister took proceedings, and the action was heard before Mr. Justice Avory, when his wife went into the witness box and said she had concealed the fact from Mr. Lister that the reversionary interest had been charged. His wife and son had not concealed the matter from Mr. Lister for the purpose of defrauding him, but it was done inadvertently. When the case was heard, judgment was given against him and his wife with costs. He attributed his failure entirely to losses on the electrical engineer's business he purchased for his son, and to his household and personal expenses having exceeded his income. He only kept rough books of accounts in connection with the business. He had never failed before, or made any arrangement with his creditors. The examination was ordered to be closed.

Arthur Nicholas Pazolt, described as an electrical engineer, of 58, York Street, Westminster, "The Tapestries," Old Windsor, and the Public Schools Club, Albemarle Street, Piccadilly.—An application was made on November 5th to Mr. Registrar Brougham, at the London Bankruptcy Court for an order of discharge. Mr. J. B. Knight, Official Receiver, reported that the bankrupt failed in December, 1913, with liabilities £696; the assets had realised £37, and no dividend had been paid. He was an American citizen, and by profession an electrical engineer. From 1906 to 1911 he acted as assistant engineer to the Brighton Corporation. In the latter year his mother died, and he became entitled to property in America of the value of about £55,000. The failure was attributed to extravagance. After hearing Mr. Hansell in support of the application, his Honour granted a discharge, subject to a suspension of two years. Order entered accordingly.

J. W. Dewhurst, electrical engineer, 52, North End Road, West Kensington, London, W.—Receiving order made November 2nd on creditor's petition. First meeting, November 15th; public examination December 8th; both at Carey Street, W.C.

G. J. T. J. Parfitt, consulting electrical engineer, Keynsham, Somerset.—November 23rd is the last day for the receipt of proofs for dividend by Mr. C. H. King, 26, Baldwin Street, Bristol.

Catalogues and Lists.—Mr. Chas. Willetts, Jun., Colonial Works, Cradley Heath.—Illustrated and descriptive circular giving prices of "Eclipse" screw pulley blocks.

The Electrical Supplies Co., 53 Victoria Street, London, S.W.—Illustrated folder showing the "Quead" and "Ensign" electric fires and their convenient employment in the household.

The Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, London, S.W.—Eight-page publication ("E.A.C. Notes") giving many small illustrations of, and particulars regarding, their house service meters, C.C. motor-starters, motor control panels, gear, oil-immersed switch gear, &c.

Messrs. J. & W. B. Smith, 15-23, Farringdon Road, London, E.C.—Thirty-two page illustrated catalogue (No. 101) in which are well shown and priced a variety of designs of electric light fittings and glassware. This is a supplementary catalogue, and the contents cover many artistic brackets, hall lanterns, electroliers, adjustable pendants, electroliers with chain suspension, Holophane reflector bowl fittings, semi-direct lighting fittings, silk shade pendants, portable standards, fancy bead and glass shades, semi-direct lighting bowls, and opal and enamelled iron shades. Three pages are devoted to a range of electric cooking and heating apparatus. A separate sheet shows six designs of "Glasmi" electric fires, and gives prices and other particulars of same.

The "Z" Electric Lamp Manufacturing Co., Ltd., and Reduced, Southfields, London, S.W.—Small pocket price list of "Z" drawn wire lamps and "Z" half-watt lamps. Quantities, overprinted for dealers' use, can be supplied on application.

Electrical Openings in France.—H.M. Consul-General in Paris (Mr. W. R. Hearn) reports that an electrical engineering firm in that city established for over forty years, which has brought into being several of the electric lighting sectors of Paris, desires to secure the agencies of United Kingdom manufacturers of electrical supplies of all kinds. This firm adds that after the war there will be a great demand for electrical supplies for refitting the factories and lighting plants in those parts of France at present invaded. A unique opportunity will be afforded for United Kingdom manufacturers to secure a large part of the market formerly in German hands. The name, &c., of the firm can be ascertained on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Trade Announcements.—It is announced that the business of the late Mr. Geo. Redhouse, electrical engineers, of Hitchin Street, Baldock (Herts.), will be continued by the executors, with Mr. Ralph Doult as manager.

The Allies Electric Lamp Repairing Co., Ltd., of Hammersmith, are prepared to repair burnt-out metallic-filament lamps by a patented process.

Mr. Alfred A. King, for many years with Messrs. G. Straus and Co., Ltd., has started business in partnership with Mr. Greenhill Owen, under the name of Owen, King & Co., Ltd., at 211, Shaftesbury Avenue, London, W.C., as electrical factors. He desires to receive manufacturers' catalogues.

Book Notices.—"British Standardisation Rules for Electrical Machinery (excluding motors for traction purposes)" Report No. 72 of the Engineering Standards Committee. London: Crosby Lockwood & Son. Price 10s. 6d. net.—This Report entirely supersedes Report No. 36, published in August, 1907. The Rules, which do not apply to traction motors, are divided into 20 sections dealing with types of machines, classes of rating, maximum cooling air temperature, measurement of temperature, embedded temperature detectors, limits of both temperature and temperature rise, mechanical and stalling requirements, dielectric tests, transformer terminal marking, &c. The subjects are dealt with very completely, the Report containing 123 clauses. The Committee has had the benefit of the co-operation of the American Standards Committee and the Canadian National Committee of the I.E.C. in its work, with the result that on all essential points the American and British ratings of electrical machinery are in practical agreement. All interests concerned have been fully consulted, and the Sub-Committee includes representatives of the large spending departments of the Government, of the I.M.E.A., of the B.E.A.M.A., and of the consulting engineers. A single rating has been adopted, and the equivalent of the overload previously specified has been included in this single rating. A value for the maximum cooling air temperature has been adopted, namely, 40° C. A very complete section deals with dielectric tests, and the information to be given on the rating plate is set out in detail. Diagrams for three-phase transformers are included, and the methods to be adopted for marking the terminals of single and three-phase transformers are specified. We shall review the Report in an early issue.

"Institution of Electrical Engineers, List of Officers and Members." 1915. London: The Institution.

"Reports of the Tokyo (Japan) Electro-Technical Laboratory." No. 16. "Transmission Losses in Common-Battery Subscribers' Loops." No. 17. "Transmission Losses in Telephone Lines."

LIGHTING AND POWER NOTES.

Acton.—Minimum Charge.—The Metropolitan Electric Supply Co. has notified private consumers that in future a minimum charge of 13s. 4d. per quarter will be made.

Argentina.—The grandiose scheme for utilising the great waterfall on the Rio Uruguay called el Salto Grande, for the generation of electricity on a large scale to supply Uruguay, Brazil, and Argentina, for which a Frenchman named Mollard secured a concession some two years ago, has come to an inglorious end by the National Congress withdrawing the concession. The concessionaire had failed to find the capital in France or to float the company to realise his aims. An electric plant is in course of installation in the township of Rawson, in the Chabut department, to supply current in that locality and in the neighbouring township of Trelew. On September 20th an electric service was formally inaugurated at Arequito, with Westinghouse dynamos driven by producer gas engines supplying continuous current at 220 volts. A small plant has also been installed at Devoto, in the Cordoba Department.

Australia.—Victorian Electricity Undertakings.—The annual official return of electricity supply undertakings operating in Victoria under the Electric Light and Power Act, shows that 107 orders have been granted, eight have been cancelled and in six cases the powers have been transferred to others. The largest undertakings are those of the Melbourne City Council with a plant capacity of 17,750 KW. and connections amounting to 23,271 KW., and the Melbourne Electric Supply Co., Ltd., with 14,100 KW. of plant and 30,884 KW. of connections; the North Melbourne E.T. and Lighting Co. at Essenden has a 1,000-KW. plant, while the Electric Supply Co. of Victoria, at Ballarat and Bendigo, has plants of 1,725 and 1,750 KW. respectively. The Melbourne E.S. Co. also has a 1,000-KW. plant at Geelong. The great majority of the installations are of under 100 KW. and gas engine-driven plant largely predominates. As would be expected, overhead transmission and distribution is a feature of all the undertakings; the Melbourne City Council has 150 miles of overhead conductors, and the Melbourne E.S. Co. 1,438 miles, in the metropolis and suburbs. A majority of the undertakings supply public lighting, and in Melbourne the returns show 721 arc and 1,392 incandescent lamps under the Council, and 200 arcs and 1,217 incandescents under the Supply Co.

A scheme has been submitted to the Minister for Mines for the erection of a big electric power station, in a central position, to supply electricity to the shaft head of each mine on the three lines of reef at Bendigo, to operate special pumping plant for drainage purposes.

Hydro-Electric Scheme.—A proposal to use the waters of the Kiewa River, in the north-eastern district of Victoria, for the generation and transmission of electricity in bulk to Melbourne, and to municipalities *en route*, has been placed before the Minister of Water Supply by the Victorian Hydro-Electric Co. The cost of the undertaking is estimated at £1,000,000.

In view of the fact that there are various schemes suggested for the supply of electricity for lighting and power to South Brisbane and neighbouring districts, and as the Queensland Government considers that municipalities should, wherever practicable, undertake these enterprises themselves, it has decided to appoint a

competent authority on electrical engineering to inquire into, and report upon, the advisability of establishing a Government power station, and to report on the utilisation of waste gases from the coke ovens, and the practibility of transmitting power to the city of Brisbane, and other matters dealing with the question of electric supply.

The Katoomba Municipality (N.S.W.) is taking steps to augment the local water supply, the dam of the waterworks having been raised to give a total capacity of 35,000,000 gallons; the question of utilising electricity for pumping from the dam to the reservoir is being considered, and the Katoomba Electricity Supply Co. has quoted 1½d. per unit for a 10 years' period.—*Tenders.*

Bacup.—Mill Supply.—The Corporation has acceded to applications from Throstle Mill and from New Hey Mill for electricity for power. An application from Messrs. Hartley Bros., Albion Mill, has been referred to a Sub-Committee to be dealt with.

The question of granting a reduction in the charges for current for lighting supplied to the Lighting Committee on account of the reduced street lighting, has been referred to a Sub-Committee.

Ballymote (Co. Sligo).—E.L. Scheme.—A meeting of business men has decided to proceed with the scheme for the electric lighting of the town, at an estimated cost of close upon £1,000.

Barking.—The Council has decided to accept the offer of a loan of £13,654 at 4½ per cent. with commission, including stamps of 1½ per cent., the loan to be for a period of 10 years certain, and to be used for electrical extensions.

Belfast.—The City Council has received a deputation from the Amalgamated Society of Engineers with reference to the appointment by the Electricity Committee of a senior and junior engineer-in-charge on probation. The Society considers that the position should be given to mechanical engineers. The Chairman of the Electricity and Tramways Committee recently stated that the Home Office inquiry into the circumstances connected with the fire at the power station had been held, but the report had not yet been furnished to the Committee.

Birmingham.—Nechells Plant.—It is expected that current would be available from the new temporary 10,000-kw. power station at Nechells in about a fortnight,

Bo'ness.—Proposed Extension.—The T.C. has rejected, by 6 votes to 5, a motion that the proposed extension of the electricity works was necessary at the present time, so that the petition to the Scottish Secretary becomes of no importance. A difficulty arose as to how the Council was to reply to the petition, and the eventual finding was in effect to back up the petitioners' arguments, and to leave the Scottish Secretary to decide the controversy.—*Edinburgh Evening Despatch.*

Clayton.—Prov. Order.—The U.D.C. has decided to obtain further information as to the Yorkshire Electric Power Co.'s application for a prov. order. It was stated that there should be some definite understanding as to the time within which the company would commence the supply.

Dover.—The T.C. has entered into an agreement with the Post Office authorities to supply current for lighting the Postal premises at 4½d. per unit on a guaranteed yearly consumption of 12,000 units. Owing to the small quantity of current used for lighting garages and by prepayment meter consumers, it has been decided to charge the former consumers a minimum of 10 units per quarter, and the latter a minimum of 20 units. The electrical engineer has suggested that the charge for motor meters should be 3s. for the meter, plus 1d. per each horse-power.

Downham Market.—Proposed E.L. Scheme.—The Council has received a letter from Mr. C. H. Best, of Bradford, stating that it is proposed to form a company for the purpose of supplying electric light and power to the town. It has been decided to consider the matter.

East Ham.—Electricity Charges.—The Electric Light and Tramways Committee has reconsidered the suggested increase of 20 per cent. in the charges for all current supplied, and now recommends that the charges should be increased by 10 per cent. (with the exception of current supplied for public lighting) to commence with current supplied during the March 1916, quarter. The question of the charges for public lighting was deferred. The Council having considered the recommendation has, by 9 votes to 8, referred the recommendation back for further consideration.

Fakenham.—Proposed E.L.—The Council has decided to inform Mr. C. H. Best, of Bradford, that as a Council it would not oppose his proposed electricity scheme.

Hastings.—Price Increase.—The Corporation has decided to increase the charges for public lighting (during the continuance of present conditions) by an addition of 10 per cent. This is equal to a sum of £2,447 for the half-year.

Heywood.—The formal opening of the extensions at the electricity works in connection with the taking of a bulk supply from Bury took place on Saturday last.

Hoylandswaine.—Prov. Order.—The U.D.C. has decided to support the application of the Electrical Distribution of Yorkshire, Ltd., for a prov. order, on condition that a clause is inserted giving the local authorities the option of purchase at the end of 21 or 35 years.

Ingleton.—Village Lighting.—The Parish Council last week again considered the question of lighting the houses constituting the model village. It was reported that an arrangement had been made with the Electric Light Co. for the erection of poles, wires, &c., complete, on payment by the Council of from £32 to £35. It was the intention to erect 10 lamps, at a cost of about 26s. each, as compared with 22s. 10d. for the present lamps. It was decided to accept the offer.

Larne.—The Urban Council has agreed to a proposal of the Larne Electric Lighting Co. that a proportional allowance at the rate of £100 for the full year should be made in view of the extinction of the whole of the public lighting at 11 p.m., as from November 1st last to July 31st, 1916.

Llanfyllin.—Street Lighting.—Owing to the local gas company having increased the price of gas, the Council, as a measure of economy, has decided to discontinue the lighting of the streets. An offer has been made by Mr. R. A. Jones, builder, to light the town with electricity from a new plant which he proposes to install, and the Council has decided to give him permission to experiment with the scheme, on the understanding that the Council does not bind itself to adopt electricity for public lighting. —*Montgomery Times.*

Leyton.—Loan Sanction Refused.—The L.G.B. has informed the Council that the application for sanction to a loan of £18,158 for the electricity undertaking cannot be entertained at the present time, but a loan of £500 for money already expended on services has been sanctioned.

London.—St. Marylebone.—The Electricity Committee has decided that, in future, only in exceptional cases are the department representatives to name a contractor, when customers require installation work carried out; customers are to select the contractors whom they wish to quote for their requirements.

During the quarter ended June 30th, 3,067,675 units were sold, a decrease of 9·6 per cent. compared with the 1914 quarter; similarly, the gross revenue, £32,865, showed a drop of 2·07 per cent. Working and management costs amounted to £16,873, an increase of £1,157; the average working expenses per unit sold were 1·318d., as against 1·1d. in 1914, and generation costs amounted to ·648d., as against ·486d., due to the heavier cost of coal.

Hackney.—The Electricity Committee recommends that a contract for the supply of electrical energy at 6,000 volts, to a new factory to be erected, be entered into with Messrs. Dick, Kerr and Co., Ltd., on terms and conditions which have been approved by the Committee.

Battersea.—The Electricity Committee has considered the question as to the means to be adopted to secure the payment of 10 per cent. on the accounts for the supply of electrical energy through prepayment meters, and is arranging for a charge of 9d. per meter per quarter, to be made payable in advance.

Luton.—The Electricity Committee has decided to utilise a portion of the highways depôt, for the extension of cooling towers in connection with the new plant at the electricity works.

Malvern.—An application by the U.D.C. for the whole of the staff at the electricity works to be allowed to remain at their work, and to be exempted from military service, has been refused. As the staff's services are indispensable, an appeal is to be made to the local tribunal set up under Lord Derby's scheme.

Manchester.—Heating Research.—The Sanitary Committee has adopted a resolution to the effect that application be made to the Committee of the Privy Council for Scientific and Industrial Research for a grant of £400 for the purposes of research into the efficiency of domestic heating appliances.

Monaghan.—E.L. Scheme.—A company has been formed for the installation of electric lighting and to buy the undertaking of the Gas Co. The Urban Council has given permission for the erection of poles and wires.

Nelson.—Year's Working.—There was a profit on the Council's electricity department for the past year of £1,145, as against £1,903 in 1913-14.

Newcastle (Co. Down).—Cottage Lighting.—The Urban Council has decided to ask the Electric Lighting Co. to install electricity in the workmen's houses, and charge a fixed rate per week, an arrangement of this kind having been made at Ballyclare (Co. Antrim).

Peterborough.—Price Increase.—The T.C. has decided to increase the charges for current by 10 per cent. as from October 30th, and has asked the Electric Traction Co., Ltd., to agree to pay a similar increase for current used by it under contract.

Sandgate.—Restricted Lighting.—The U.D.C. has sent to the Folkestone E.L. Co. a request that the rebate in respect of public lighting should be increased from £210 suggested by the company, to £245 or £250.

Shanklin.—Street Lighting.—The U.D.C. has received a letter from the Electric Light Co. agreeing to accept half the amount of the contract price for the eriod ending March 31st.

Shelf.—Prov. Order.—Consideration of the application of the Electrical Distribution of Yorkshire, Ltd., for an electric lighting order for the district, has been deferred until the next meeting of the Council.

South Africa.—Train Lighting.—In the last annual report of the general manager upon the working of the South African Railways, it is stated that:—"The experiment commenced in 1912 with Edison cells for block train lighting at Cape Town for suburban services, having proved entirely successful, this is being generally extended in the Cape suburban area. In 1912 a trial was also made with the Vickers train lighting system, six sets being fitted to main line stock. The trial has proved fairly satisfactory, although no great improvement over other systems has been demonstrated. A further six sets have also been ordered for equipping certain coaches now being erected in England. One equipment was also purchased from Messrs. Mather & Platt, and is giving satisfaction."

Southport.—Year's Working.—The annual report of Mr. Black, borough electrical engineer, states that the result of the year's working was a net profit of £2,213, an increase of £350 in comparison with that of the previous year. There was an increase in the number of units supplied to the Corporation tramways, but a decrease in the number supplied to the Southport Tramways Co. There had been a large reduction in the supply of current to private consumers, but this had been more than counterbalanced by the increased number of consumers and the more extensive use of electricity for purposes other than lighting. Much revenue had been lost through the restrictions upon outside shop lighting.

Stretford.—Annual Accounts.—The abstract of accounts for the last financial year, which has just been approved, shows that on the electricity department the total expenditure on capital account amounted to £109,173, and the balance of loans outstanding was £77,537. The trading account showed a net surplus of £251.

Swindon.—G.W.R. Plant.—At the wagon building department of the Great Western Railway at Swindon, a gas-electric plant is in use for supplying the motor driving. This includes three sets of producer plant supplying gas to three 290-B.H.P. Campbell gas engines direct-coupled to G.E.C. 150-KW. compound-wound generators. The engines are of the four cylinder vertical pattern running at 220 R.P.M. The switchboard was constructed by the company's electrical staff.

Turton (Lancs.).—The U.D.C. has adopted the scheme of the electrical engineer to supply residents of Riding Gate, Harwood, with electricity, at a cost of £220. A few public street lamps will be converted to electricity when the supply is available.

Warminster.—The B. of T. has granted a year's extension of time for carrying out the work scheduled under the E.L. order.

Winchester.—Despite the great increase in the cost of production of current, the T.C. has decided not to increase the tariff at present. As the contractors for the new plant for the station are entirely engaged on war work, and cannot give a definite date when the plant will be delivered, the Council has purchased a second-hand 200-KW. generating set for £760, to assist in maintaining the supply during the winter. The Electricity Cammittee has intimated that it does not propose, after the end of the year, to retain the consulting engineers, and will in future only engage them when necessary for particular work.

TRAMWAY and RAILWAY NOTES.

Birkenhead.—Year's Working.—For the year ended March 31st last, the total receipts of the Corporation tramways amounted to £65,785, while the gross profit was £26,318, or £898 less than 1913-14; after meeting interest and sinking fund charges there remained a surplus of £4,500, of which £1,000 was placed to reserve and the balance to renewals. The net surplus has only once been exceeded in the history of the undertaking; £4,750 was spent on renewals during the year, and the fund at March had £22,062 in hand. During the year 14,822,697 passengers were carried, giving an average revenue of 13·05d. per car-mile; the system covers nearly 14 miles of route.

Dover.—Light Railway Order.—The B. of T. has renewed until February, 1916, the Dover, Martin Mill, and St. Margaret's Light Railway Order.

Edinburgh.—Tramway Fares.—A conference of representatives of the Tramway Committee of the T.C. and a deputation from the Tramway Co. has discussed the proposed new scale of tramway fares. It was pointed out for the company that it had to meet increased expenditure, which amounted to about £25,000, and which did not include allowances which it was making to dependents of employés. The company offered (an offer which the Committee refused) to retain the fares at the present rates provided the Corporation would guarantee the company the same rate of profit as had been realised during the last three years. The deputation also pointed out that similar action had been taken by the Birmingham tramways (which were owned by the Corporation), by which it was expected to raise additional revenue to the amount of £100,000. In making the increases the Edinburgh Co., it was stated, was acting quite within the provisions of the lease, and it was the duty of the company to look after the interests of the shareholders. The deputation from the company expressed its willingness, at the end of three months, to reconsider the matter if the increased fares were producing more money than was necessary to cover the additional expenditure.

Female Conductors.—The vogue of the lady conductor is making great progress in Lancashire. The first women conductors started work at Ashton under-Lyne last week; Darwen and Nelson have decided to employ them, and Stalybridge and Southport have both engaged a number of them. Manchester is inviting further applications from women desirous of acting as car conductors, and at Liverpool a large number of applications have been received for such positions.

Hastings.—Female Inspectors.—The women tramway conductors are reported to have been so successful that during the past week women inspectors have been introduced to replace men joining the army.

London.—L.C.C. and Female Labour.—The Highways Committee recommends that the employment of women conductors on the Council's tramcars be authorised during the war, and that they be paid proportionately to the time worked at a rate equivalent to the daily rate of male conductors.

Owing to the difficulty of obtaining unskilled labour, the Committee also recommends that women be employed at the central car repair department on work of an unskilled character in connection with the repair of tramcars, the commencing rate of pay to be 20s. a week, with 3s. war bonus.

Nelson.—Year's Working.—The profit on the light railways for the past year was £314, as compared with £1,980 in the previous year.

Oldham.—War Bonus.—Clerks in the tramways department who were excluded from a war bonus award have made application to be included among those receiving the bonus, and the Tramways Committee has decided to send their application to the special committee which has been dealing with the war bonus question, with an expression of opinion that the clerks ought to be included.

Recently the Corporation were defendants at the Manchester City Police Court, having been summoned for using a too brilliant lamp on a car in the Manchester area. It was pointed out that the lighting restrictions were not now applicable to Oldham; but the Failsworth area, through which the cars pass, was very badly lighted, and it was not considered safe to reduce the lighting of the cars further. The summons was dismissed.—*Manchester Courier.*

Rochdale.—Wages Increase.—The Tramways Committee has decided to recommend an advance of a halfpenny per hour to employés earning 30s. or under per week, and an advance of a farthing per hour to employés earning over that amount. As previously reported, the war bonus arrangement under which the men on the lower scale got 2s. per week and the men on the higher scale 1s. per week, is to come to an end on the 18th inst. The war bonuses were estimated to amount to about £800 per annum, and the new permanent increases now to be recommended will mean about £1,100 per annum to the department.

West Hartlepool.—Female Conductors.—Owing to enlistments on the part of the staff, the T.C. has decided to engage female conductors for the tramcars.

Wolverhampton.—Year's Working.—The accounts of the Corporation tramways department for the year ended March 31st last showed a gross profit for electric traction of £20,257; and after meeting interest and sinking fund charges, the net profit on tramways and omnibuses was £9,160, from which £396 was carried to renewals, £5,020 devoted to additions to plant, and £3,744 to rate aid. The reserve fund now stands at £53,987. For the first six months of the present financial year 6,617,063 passengers were carried, the receipts amounting to £29,524 (12d. per car-mile), all figures being in excess of those of 1913 and 1914.

In its annual report to the Town Council, the Tramways Committee states that after consideration it has resolved to issue free passes to wounded soldiers in the borough, which will enable them to travel to and from the town once daily.

York.—Female Conductors.—So many of the employés of the Corporation tramway staff have enlisted, that the T.C. has decided to employ women conductors.

CHARLES P. SPARKS, President of the I.E.E.

On October 1st the office of President of the Institution passed from Sir John Snell to his successor, Mr. Charles P. Sparks, M.Inst.C.E., M.I.E.E., who will be installed in the chair on Thursday next.

Whilst offering him our congratulations on the attainment of the highest honour that the Institution can bestow on any of its members, we are pleased to be able to present his portrait to our readers—though he is so widely known and so generally popular that there can be few members of the Institution, at any rate, who are not already familiar with his likeness.

Mr. Sparks, who was born in London in 1866, was educated at Repton School, and later entered the Hammond Electrical Engineering College (now known as Faraday House), to which is due the credit for having trained so many of the prominent leaders in the electrical profession. Leaving the College in 1884, he became an engineering pupil in the workshops of the Ferranti-Hammond Co., and subsequently assistant to Mr. S. Z. de Ferranti, who was then developing his system of high-pressure distribution with transformers; in 1887, *i.e.*, at the age of 21, he entered into partnership with Mr. Ferranti and Mr. Francis Ince, the firm carrying on business as S. Z. de Ferranti & Co., in London and Paris, and he was a director of Ferranti, Ltd., until 1899.

From 1886 to 1891 Mr. Sparks had charge, under Mr. Ferranti, of the Grosvenor Gallery lighting station and distributing mains, and supervised the erection of additional machinery at that station; during this period the business was transferred to the London Electric Supply Corporation, and while the Deptford station was being erected, Mr. Sparks supervised the laying of the first 10,000-volt transmission mains and the equipment of the main sub-stations. Thus he was at the very heart of the electrical world in those pioneering days, when everything that was done was something new, and monotony was the very remotest risk of an electrical engineer's existence.

Photo. by] CHARLES P. SPARKS. *[Russell, Baker Street.*

In 1891 Mr. Sparks left the London Electric Supply Corporation, and became works manager to the Ferranti Co., in which capacity he carried out contracts for the manufacture and erection of engines, alternators, and electrical equipment for many power stations. He became chief engineer of the County of London Electric Supply Co. in 1899, and is now acting as engineer-in-chief to this company, which gives general supply in an area of 23 sq. miles out of the 117 sq. miles included in the Metropolis; the company is also supplying areas outside the Metropolis aggregating some 160 sq. miles.

Since 1899 Mr. Sparks has carried on a consulting practice, having taken his brother, Captain H. C. Sparks, into partnership in 1907. The principal work carried out has been in connection with the erection of electric power plant industrial undertakings, covering collieries, metalliferous mines and mills in Great Britain, U.S.A., India and the Colonies.

His connection with the Institution of Electrical Engineers dates from 1885, when he was elected a Student; he became an Associate Member in 1899, and Member in 1905. He served as Associate Member on the Council in 1892, as Member of Council, from 1900 to 1907, and as Vice-President from 1907 to 1909. He became Associate Member of the Institution of Civil Engineers in 1894, and full Member in 1900.

Mr. Sparks has served on many Committees of the Institution of Electrical Engineers, including the Wiring Rules Committee, with which he has been connected for twenty years, having been chairman for fifteen.

He is also a Member of the Engineering Standards Committee as one of the representatives of the Institution of Electrical Engineers.

His contributions to the *Proceedings* of the Institution include two papers respectively entitled: "The Electrical Equipment of the Aberdare Valley Collieries of the Powell Duffryn Steam Coal Co., Ltd." in 1906, and "Electricity Applied to Mining" in 1914.

The comprehensive experience which the new President has acquired in the course of his career, and the ability of which he has given so many proofs, together with the high esteem in which he is held by all who have come in contact with him, afford a guarantee that his period of office will be in no way less successful than previous terms.

So far we have referred only to Mr. Sparks in his professional capacity, but as a citizen of the Empire he is equally entitled to honour and congratulations, for three of his four sons are serving with the Colours—one in the Royal Engineers, one in the Royal Artillery, and one, the youngest, in the Suffolk Regiment. The last has so distinguished himself in action that he has not only been mentioned in dispatches, but has also been awarded the Military Cross by the King. This is, indeed, a record to be proud of, and we offer our respectful congratulations to Mr. and Mrs. Sparks.

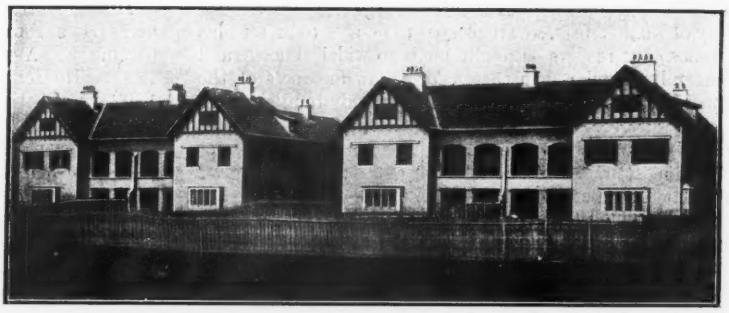
The new President assumes office in a period of stress, and will have many opportunities of assisting the Government in connection with military matters; in such circumstances his wide experience will no doubt prove of the greatest value. We trust, however, that before he vacates the chair the cause of the Allies will have triumphed, and that the blessings of peace will have been restored to this country.

E

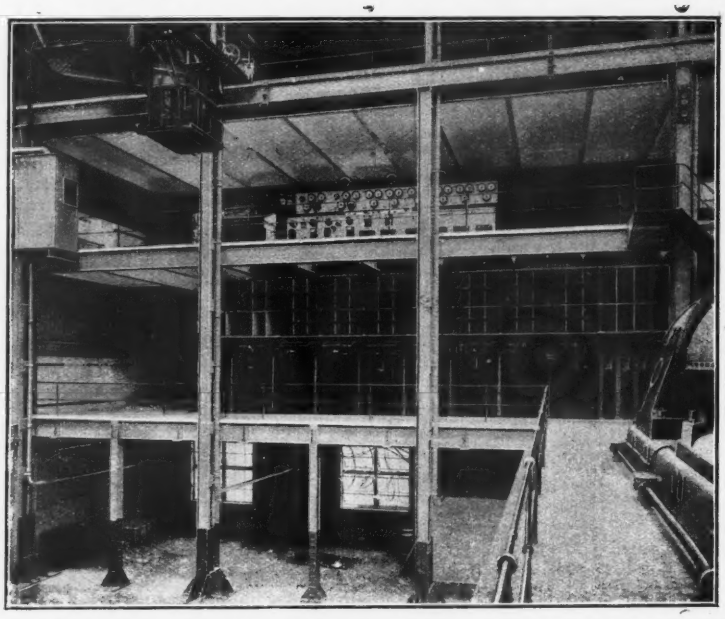
SHANGHAI ELECTRICITY WORKS.

(*Continued from page* 594.)

The low-pressure distributing networks are fed from sub-stations, varying from about 100 kw. in the small sizes to 2,000 kw. in the larger ones. Whilst pressure regulation on the single-phase feeders is effected by means of automatic feeder regulators or boosters installed at the Fearon Road centre, in the three-phase sub-stations the pressure regulation is performed by three-phase regulators installed in the sub-stations and connected between the 6,000-volt feeder bus-bars and the transformer bus-bars of the sub-station E.H.T. switchgear. These feeder regulators were made by the G.E. Co., of New York. All high-pressure and extra-high-pressure feeders are on the ring system or else duplicated, thus ensuring continuity of supply. All low-pressure overhead mains are of bare hard-drawn copper cable; the single-phase high-pressure cables are weatherproof, but the E.H.T. three-phase overhead mains are bare, as these can only be run in outlying districts, whereas the 2,100-volt single-phase cables run through congested areas. Trouble from breaking or short-circuiting of the overhead cables, either low, high or extra-high-pressure, is almost unknown, which speaks well for the safety of a carefully-planned and erected overhead system. Oregon pine poles are used almost exclusively. These are protected by cast-iron sleeves at the wind and water line. Concrete poles are used where cables are run in and out of sub-stations. Lightning occurs in the summer season, but in recent years, owing to a carefully-arranged use of arresters in the sub-stations and Fearon Road centre, little serious trouble has been experienced. The result of several years' use of various types of arrester shows that the aluminium arrester gives the best protection. The arresters of this type are fitted with automatic recorders, which show the number of discharges which take place.

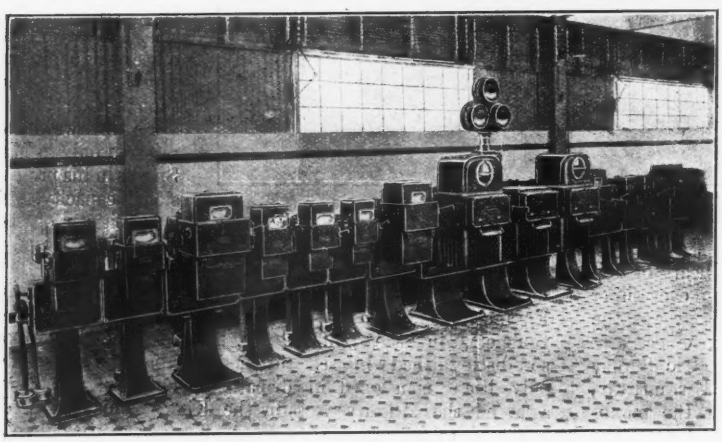


Staff Engineers' Quarters.



Riverside Power Station: British Westinghouse 6,600-volt Switchgear, and Control Desk above.

All the feeders, both single and three-phase, are looped and not teed into the sub-stations, so that any section can be isolated without interfering with the others. All the transformers, even down to 20 kw., are oil-cooled, it being found that the oil affords a valuable protection against damage by lightning on the overhead system. In country districts where sub-stations are not justified by the load, pole-type transformers of 10 kw. are used, but this is in comparatively rare instances; the pole-type system of transformation and distribution is not favoured, sub-stations of permanent construction being usually adopted.



British Westinghouse Mining-type Switches for Control of Station Auxiliaries.

The transformers in use are single-phase and some three-phase, made by the British Electric Transformer Co., Ltd., and three-phase made by the British Westinghouse Co., Ltd., and the General Electric Co., of New York, all oil-cooled.

Lighting generally is supplied at a flat rate equivalent to 3d. per unit. For power there is a sliding scale from a maximum of 1d. per unit down to 0·3d., and for heating and cooking the price is 0·7d. per unit. No meter rents are charged. The single-phase meters used for house services are mostly made by Messrs. Ferranti Ltd., and Messrs. Chamberlain and and Hookham, Ltd. Three-phase meters are used for power work, and are mostly of British Westinghouse make.

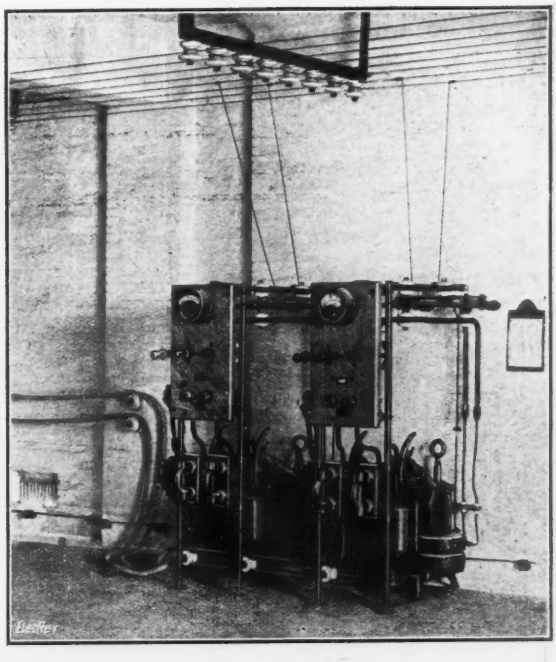
So great is the amount of work—both routine and new construction—going on always, that a fleet of 10 petrol cars

is needed, and a 2-ton lorry. To these have recently been added three electric runabouts and a 2½-ton electric lorry, so that in this respect Mr. Aldridge is in the forefront of progress.

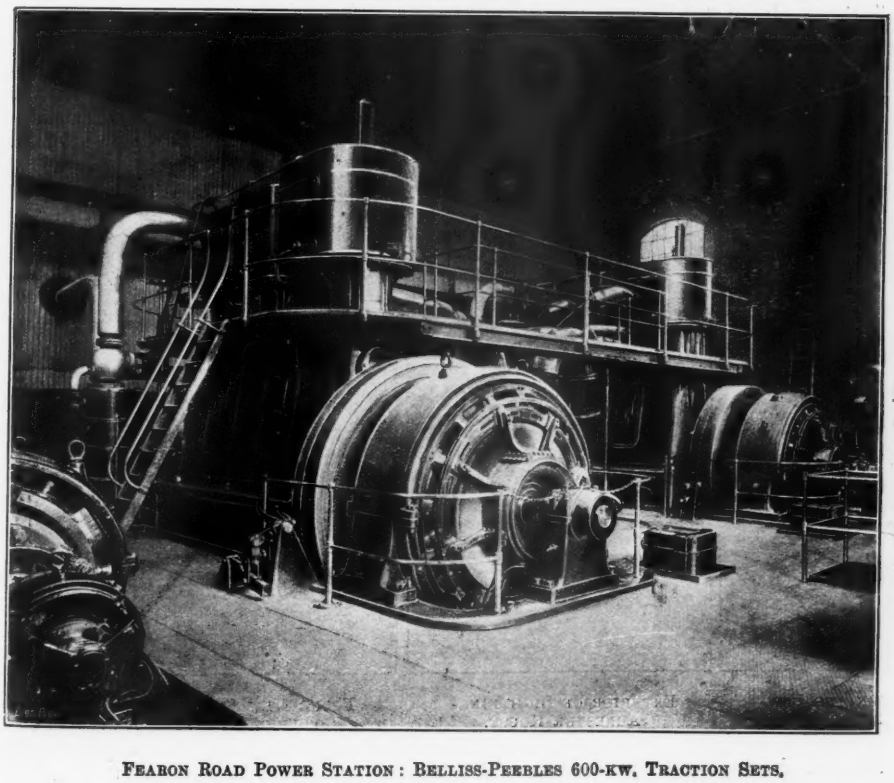
All electrical energy is charged for by meter, or alternatively on the fixed-rate system with the help of current limiters.

The cost of coal varies, but is usually between 12s. and 15s. per ton.

Riverside: Brick and Concrete Cubicles for 6,600-volt Switches.



Constant-current Series Transformers for Public Lighting.



Fearon Road Power Station: Belliss-Peebles 600-kw. Traction Sets.

Shanghai is an important manufacturing centre. The principal industry is cotton spinning. Cotton is grown extensively in the neighbourhood, but cotton is also imported from other countries. The very low cost of electric power attracts new industries, and great development is expected in the near future.

As the cotton mills, of which there is a large number in the town, work day and night for 330 days in the year, they offer a splendid load factor, and thus the phenomenally low rate of 0·3d. per unit mentioned above is made commercially practicable. In 1915 Mr. Aldridge expects the total output will amount to 50 million units, and the following year it may exceed 60 millions; one cotton mill alone, which requires 2,500 kw. day and night, is expected to consume no less than 17 or 18 million units! At present there are orders on the books for over 10,000 kw. in industrial work, including cotton and rice mills in addition to the normal increase in small motors, such as those employed to drive printing presses and in various other minor industries. It is interesting to record that the department is supplying power for operating hydraulic packing presses for pressing bales of raw hide, &c., and steam presses are being replaced by electric motor-driven presses. Suction gas and steam installations are being superseded by electricity, and electric motors are now used almost exclusively in the smaller trades.

The development of the supply has necessitated a great deal of energetic missionary work, but now there is abundance of work in prospect. Probably now that the opium trade is dying out, some of the Indian traders will turn their

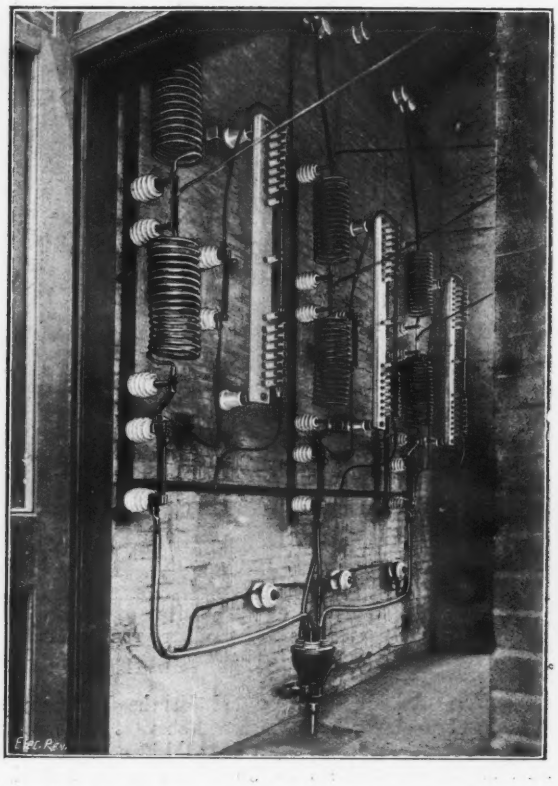
attention to cotton, and there is plenty of scope for further development.

The European staff comprises over 70 persons, including engineers, clerks, collectors, &c. Twenty per cent. of the staff came home and entered the Army, but this by no means represents the percentage of men willing to serve; but it was found impossible to accede to all the requests from the staff, as important work in Shanghai calls for the loyal co-operation of the rest of the staff. The Chinese staff numbers about 800. Four houses for shift engineers are to be erected on the station site, and will be provided with tennis courts, &c. There is room on the site for 100,000 KW. of plant.

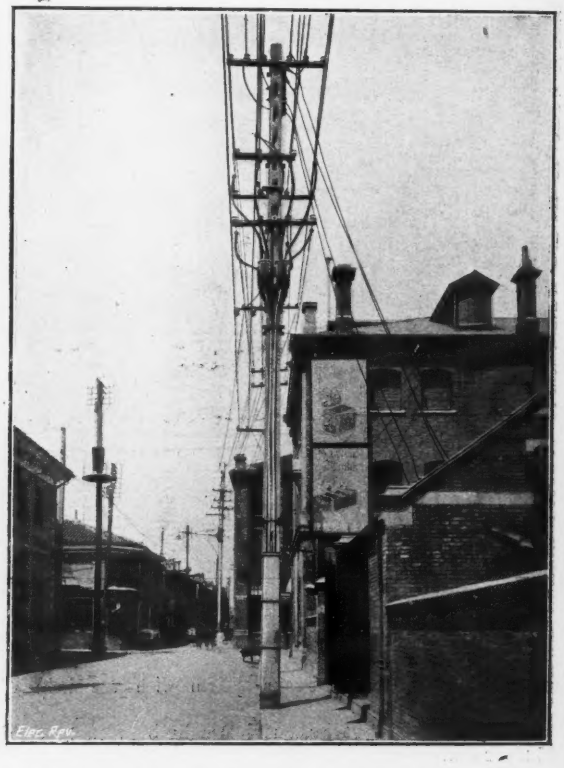
The whole of the work of preparing consumers' accounts and issuing debit notes is carried out by the electricity department, which also collects all the accounts, a completely organised staff being provided, under the supervision of the chief clerk, who is directly responsible to the engineer-in-chief. The returns only are sent to the treasurer's office.

The consumers' department is organised to deal with all complaints and look after new consumers. Under a resolution passed by the ratepayers some years ago, the department is not allowed to carry out wiring work or to sell fittings, but hires out electric cooking ranges, radiators, and motors, besides selling incandescent lamps. Last year the connections allotted to heating and cooking totalled 1,700 KW., and this year it is expected that they will reach over 2,000 KW. Radiators are being extensively used in Shanghai, especially for offices and bedrooms, and the Chinese consumers appreciate their advantages.

The street lighting of the greater part of the town and suburbs is electric, mostly on the constant-current series system operated through constant-current transformers from the



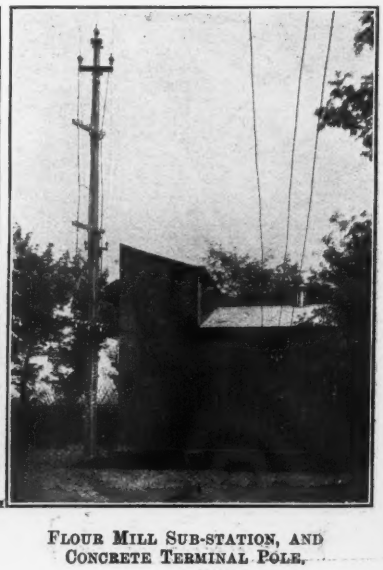
INTERIOR OF LIGHTNING-ARRESTER HOUSE, AT JUNCTION OF UNDERGROUND AND OVERHEAD MAINS.



SINGLE-PHASE SUB-STATION AND FERRO-CONCRETE POLE.

THREE-PHASE SUB-STATION AND LOW-PRESSURE DISTRIBUTORS.

EXTERIOR OF LIGHTNING-ARRESTER HOUSE.



FLOUR MILL SUB-STATION, AND CONCRETE TERMINAL POLE.

2,100-volt mains. Arc lighting is giving place to incandescent lighting, half-watt lamps being now almost exclusively used. At the end of last year there were 1,339 public street lamps in use.

(*To be concluded.*)

TELEGRAPH and TELEPHONE NOTES.

West Indies.—It is reported that a new wireless station has been installed at St. Lucia for commercial purposes.

United States.—Additions to the list of radio stations of the United States, as given by the Bureau of Navigation in its October list, include 11 special land stations and 6 ship stations.

Wireless Tower Wrecked.—At the end of September high winds prevailed in the Eastern parts of the United States, and at New York City the gale reached a measured velocity of 72 miles per hour. Large signs, trees, and telegraph poles were blown down, and at Medford, Mass., a new steel tower erected by the American Radio and Research Co. was wrecked. The tower was 312 ft. high and had been nearly finished when the accident occurred. It was mounted on a reinforced concrete foundation, and measured 3 ft. 6 in. square, being guyed at 100 ft. intervals by three-strand steel wires, the sizes of which at the two lower points of attachment were $\frac{5}{8}$ in. and at the top guying point $\frac{3}{4}$ in.—*Electrical World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—November 25th. G.N. of Scotland Railway Co. Six or twelve months' supply of telegraph material. Forms of tender from the Stores Superintendent, 80, Guildford Street.

Athy.—December 6th. U.D.C. Tenders are invited for lighting the town with electricity. Particulars from Mr. J. A. Lawler, Town Clerk.

Australia.—December 7th. P.M.G.'s Department (various States). Non-encrusting zincs, carbon and manganese powder, manganese chloride, chloride of ammonia, porous pots (2 in.), outer jars for cells, carbon blocks, resistance boxes of 5,000 ohms, &c. See "Official Notices" October 15th.

November 30th. Commonwealth Department of Defence (Navy Office). Power station, plant and equipment, and machine tools, for Commonwealth Naval Dockyard, Sydney. (Time for receipt of tenders extended from October 25th.)*

December 20th. P.M.G.'s Department, N.S.W. 4,250 telephones (Schedule 454).

January 5th, 1916. P.M.G.'s Department, Queensland. Copper wire and accessories (Schedule 356). January 26th.—Telephone instruments (Schedule 344).

January 19th, 1916. P.M.G.'s Department, S. Australia. One common multiple switchboard, Telephone Exchange, Adelaide (Schedule 405).

GOULBURN.—December 15th. Council. One 200-KW. direct-coupled generating set, gas or steam driven. Specification, 10s., from the Local Government Association, 103-4, Queen Victoria Markets, Sydney, or the Town Clerk.

SYDNEY.—December 6th. Municipal Council. 33,000-volt outdoor transformers and switchgear. Specifications (10s. 6d.) from Electric Light Department, Town Hall.

November 22nd. City Council. High-tension cable-testing outfit, consisting of a 350-K.V.A. single-phase transformer, a 175-K.V.A. single-phase potential regulator, a 1,600-K.V.A. single-phase inductance, and a control switchboard.*

December 20th. Metropolitan Board of Water Supply and Sewerage. Three centrifugal pumps and electric motors, each to pump 6,300 gallons per minute, and one to pump 15,100 gallons per minute, together with switchboards, starters, &c., for the pumping station at Marrickville, N.S.W. Deposit £10. Tenders to the Board, at 341, Pitt Street, Sydney, N.S.W.*

January 12th, 1916. N.S.W. Railway and Tramway Department. Two water-tube boilers, &c., for the Zara Street power house, Newcastle. See issue of October 8th for further particulars.

January 31st, 1916. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

MELBOURNE.—December 14th. Deputy P.M.G. Eleven sections of a lamp-signalling trunk-line switchboard, and other material necessary for increasing the equipment of Melbourne trunk exchange from 108 to 240 lines. Schedule 1,207.*

December 7th. Deputy P.M.G. Electric motors, polarised relays, Morse sounders, telephonometers and voltmeters.*

December 14th. P.M.G. For delivery in all States, 18,670 common-battery wall pattern telephones, manufactured in Australia. Sched. No. 1,264. Tenders will also be considered for instruments manufactured in countries other than Australia.*

January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

PERTH.—December 8th. 294 accumulators, and power board complete, for P.M.G.'s Dept. See "Official Notices" October 8th.

Bradford.—November 13th. Corporation. Twelve months' supply of lamp fittings, insulating material and tramway stores for the Tramways Committee. Specifications from the Tramway Offices, 7, Hall Ings.

Canada.—November 23rd. Dominion Government Department of Naval Service, Ottawa. Electric cable and wire for H.M. Canadian dockyards.*

Chatham.—November 24th. T.C. Twelve months' supply of incandescent electric lamps. Specifications from the Borough Surveyor's office, Town Hall.

Dublin.—November 15th. Twelve months' supply of stores for Dublin United Tramways Co. See "Official Notices" October 29th.

Enniskillen.—December 1st. Sligo, Leitrim and Northern Counties Railway Co. Twelve months' supply of telegraph materials. Forms of tender from Mr. J. Duff, Secretary's office.

Japan.—Electric tramway material for the extensions of Nagasaki tramways.*

Manchester.—November 17th. (*a*) Turbo-alternator plant, specifications Nos. 29 and 31; (*b*) induced draught plant, specification No. 30. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Rochdale.—November 17th. Steam coal for the electricity station. Mr. C. C. Atchison, Engineer and Manager, Dane Street.

Salford.—November 29th. Manganese steel crossings for the Tramway Department. General Manager, 32, Blackfriars Street.

South Africa.—November 15th. South African Railways. Twelve months' supply of rubber-insulated tinned-copper wire, as may be required. Secretary, Tender Board, S.A.R., Johannesburg.*

St. Helens.—November 17th. Erection of engine house and other works at Cropper's Hill power station. Particulars from Mr. E. M. Hollingsworth, Borough Electrical Engineer (£1 1s. returnable).

Upper Longhor.—November 15th. E.L. installation at new schools for Glamorgan C.C. Mr. T. M. Franklen, Clerk, Cathays Park, Cardiff.

Wakefield.—November 16th. Twelve months' supply of coal for Calder Vale Electricity Works. City Electrical Engineer, Old Town Hall.

Warrington.—November 16th. Supply of E.H.T. cable, for the Tramways Committee. See "Official Notices" November 5th.

November 24th. Cheshire Lines Committee. Telegraph materials and carbons (Schedule 6), required during 1916. Stores Superintendent, Cheshire Lines, Warrington.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Bristol.—The T.C. Docks Committee has accepted the tender of Messrs. J. H. Holmes & Co. for a 25-H.P. motor for working the ship elevator at Avonmouth Old Dock.

Elland.—The D.C. Electricity Committee has accepted the tender of Messrs. Thompson, Newsome & Co. for the supply of 50 tons of coal at the electricity works, and also for the supply of 30 tons monthly above contract quantity, at a price of 18s. 1d. per ton delivered at the works.

Glass Houghton.—The Pontefract R.D.C. has accepted the tender of the Pulsometer Engineering Co. for a 3-in. "Stereophagus" pump and electric motor.

Glasgow.—The Tramways Works and Stores Committee recommends acceptance of the following tenders:—

Trolley beams for Kinning Park sub-station.—Fleming Bros.
Soft copper strip.—Charles Hamilton & Co., Ltd.

Manchester.—The following tenders have been accepted by the Electricity Committee:—

Two sets of E.H.T. switchgear.—Ferranti Ltd.
Induced-draught plants.—Babcock & Wilcox, Ltd., and M. Leu's Prat.
One 300-KW. motor-converter for sub-station.—Bruce Peebles & Co., Ltd.
Purchase of scrap iron.—Wm. Faint & Son and James Moores.
Purchase of a cast-iron cylinder.—J. H. Broomhead.

London.—L.C.C.—The Highways Committee has received the following tenders for the provision of heating and ventilating installations at the central car-repair depôt (third section) :—

Colley, Meikle & Co.	(accepted)	£1,495
J. & F. May..		1,597
Young, Austen & Young..		1,671
W. G. Cannon & Sons, Ltd.		1,780
Brightside Foundry and Engineering Co., Ltd.		1,919
E. Deane & Beal, Ltd.		1,990
Standard Engineering Co., Ltd. ..	(incomplete)	382

The architect's estimate was £1,750.

The Asylums and Mental Deficiency Committee has accepted the following contracts :—

Electrical sundries (Schedule 64).—A. F. Goodwin & Co.; Edison & Swan U.E.L. Co., Ltd.; General Electric Co., Ltd.; Cox-Walkers, Ltd.; G. Maclellan & Co.
Electric lamps (Schedule 64A).—Pope's Electric Lamp Co., Ltd.

STEPNEY.—The Electricity Committee has accepted the offer of Messrs E. Foster & Co. for 100 tons of Walsall Wood washed beans, at 21s. 7d. per ton, and 3,000 tons of Ibstock D.S. nuts, at 22s. per ton, the coal covered by the latter offer to be delivered at the Limehouse generating station in equal weekly quantities.

Stretford.—The D.C. has accepted the tender of Messrs. W. T. Glover & Co. for cable, at £302.

Walsall.—The T.C. Tramways Committee has accepted the tender of the Daimler Co. for three additional single-deck 'buses, including extras, at £1,008 10s. each.

Watford.—The Electricity Committee of the U.D.C. has accepted the offer of Messrs. W. Cory & Son, Ltd., to reduce their contract price for Griff peas coal by 2s. 6d. per ton. Messrs. E. Foster & Co. are also prepared to reduce their contract prices of Newdigate peas by 6d. per ton, and Kingsbury nutty slack by 4d. per ton. The Clerk has been directed to endeavour to obtain a further reduction.

The U.D.C. has accepted the tender of Messrs. Connare & Co., at £227, for wiring the pumping station.

West Bromwich.—Subject to the sanction of the L.G.B. being obtained, the Electricity Committee recommends that the following tenders be accepted for extensions at the electricity works :—

Babcock & Wilcox, Ltd.—Boiler and accessories.
J. Thompson.—Steel chimney.
E. Green & Son.—Economiser.
J. P. Hall & Sons.—Feed pump.
New Conveyor Co.—Coal bunker.
J. Proctor, Ltd.—Coal elevator.
British Westinghouse Electric & Mfg. Co.—E.H.T. switchgear.

Weymouth.—The T.C. has accepted the tender of Messrs. Brooking & Co. for the electric light installation at the municipal dwellings.

FORTHCOMING EVENTS.

Greenock Electrical Society.—Friday, November 12th. At 7.45 p.m. At Temperance Institute, 19, West Stewart Street. Paper on "Kinematograph and Kinemacolor," by Mr. P. C. Kerr.

Physical Society of London.—Friday, November 12th. At 5 p.m. At Imperial College of Science, S.W. Paper on "The Effect of Electric Oscillations on the Magnetic Properties of Iron, Investigated by the Campograph," by Prof. J. A. Fleming, F.R.S., and Mr. P. R. Coursey. Demonstrations by Mr. R. S. Whipple.

Manchester Association of Engineers.—Saturday, November 13th. At Grand Hotel, Aytoun Street. Paper on "Science and Practice in Engineering," by Mr. C. E. Stromeyer.

Electro-Harmonic.—Monday, November 15th. At 8 p.m. At Holborn Restaurant. Ladies' Night.

Institution of Civil Engineers.—Tuesday, November 16th. At 5.30 p.m. At Great George Street, S.W. Paper on "The Punjab Triple Canal System," by Sir John Benton, K.C.I.E.

Nottingham Society of Engineers.—Wednesday, November 17th. At 7.30 p.m. At the Welbeck Hotel, Milton Street. Paper on "The Layout and the Equipment of Engineering Works," by Mr. F. A. Garrett.

Chemical Society.—Thursday, November 18th. At 8.30 p.m. At Burlington House. Lecture by Dr. E. J. Russell.

Institution of Electrical Engineers.—Thursday, November 18th. At 8 p.m. At Victoria Embankment, W.C. Inaugural Address by the President.

Manchester Local Section.—Tuesday, November 16th. At 7.30 p.m. At the Engineers' Club. Chairman's Address.

University College, London.—Friday, November 19th. At 5 p.m. Third Lecture on "Electric Heating and Electric Furnaces," by Prof. J. A. Fleming, F.R.S.

Institution of Mechanical Engineers.—Friday, November 19th. At 8 p.m. At Storey's Gate, S.W. Papers on "The Chemical and Mechanical Relations of Iron, Molybdenum, and Carbon," by Prof. J. O. Arnold, F.R.S., and Prof. A. A. Read, and "The Cause and Effect of 'Ghost Lines' in Large Steel Forgings," by Prof. J. O. Arnold, F.R.S.

Greenock Electrical Society.—Saturday, November 20th. Visit to the Glasgow Sewage Works at Shieldhall.

ENLISTING AND EMPLOYMENT IN THE ELECTRICAL INDUSTRY.

THE following is a copy of a circular which has been issued this week to all members of the Institution of Electrical Engineers :—

ENLISTMENT OF CLERICAL AND COMMERCIAL EMPLOYES.

At the request of the Clerical and Commercial Employments Committee of the Home Office, the Council of the Institution of Electrical Engineers desire to call the attention of employers to the urgent necessity of giving immediate and detailed consideration to the question of replacing the men now in their employ who in the near future will be called up in increasing numbers to serve in the military forces of the country.

As regards substitutes, it is understood that the supply of men who are over military age, or who have been rejected by the authorities as unfit for military service, is wholly inadequate to satisfy present and contingent demands. Of men who have been invalided out of the Army, and who will generally be regarded as having a first claim to employment, comparatively few have yet been returned to civil life. Lads under military age are being largely employed in the place of enlisted men, but here again the supply is short, and this expedient is subject to the serious disadvantage that if the employés are not far short of military age they may leave the employer just at the time when they are becoming useful.

In the case of technical assistants and skilled tradesmen, it is not possible to make any general suggestion, and the question of their replacement is one which will have to be solved by each employer according to circumstances, but as regards clerical and commercial employés it is to the ranks of women that employers must chiefly turn for substitutes. In some of the larger and more highly organised concerns, such as banks, insurance offices, &c., employers have so far experienced little difficulty in replenishing with women their depleted staffs. The women in these cases are very often the friends or relatives of members of the existing staff. The Council believe that a considerable part of the problem will be solved if large employers will adopt this means of replacing enlisted men. The women clerks so engaged are employed, at first, at all events, in the more elementary branches of clerical work, and in a surprisingly large number of cases no previous business training seems to be required.

It is certain, however, that in the near future, as men are called up for the forces under Lord Derby's scheme, there will be a great and increasing demand in all commercial centres for clerical labour which the sources of supply alluded to will be altogether unable to meet, and the above-mentioned Committee of the Home Office have accordingly decided to approach immediately the local authorities in all important towns and to invite them to start at once schemes for organising a supply of clerical workers, and for fitting them, so far as can be done in the time available, by emergency classes to supply the places of the men who will have gone.

The Council desire also to bring to the notice of the electrical industry that at a conference held at the Home Office, Lord Derby laid special stress on the desirability of giving preference, wherever possible, to women relatives of enlisted men.

In the interests of recruiting, it is highly important that the places of enlisted men should be kept open for them. This is an honourable rule, and, so far as the Council are aware, a practically universal one in the branches of employment here referred to. No less desirable is it that the employment of substitutes for enlisted men should be known to be and declared to be temporary, and for the period of the war only.

Under the circumstances, the Council wish to impress upon employers the importance of considering at once how their arrangements can best be remodelled as their present men are called up, and what number and class of women or other substitutes they will require.

Lastly, as regards the question of the exemption from military service of men regarded by the employer as indispensable for carrying on his business, the Council are informed that the arrangements on this point are under consideration.

CHARLES P. SPARKS, *President.*

November 9th, 1915.

NOTES.

America and Trade after the War.—It is stated that the American Congress will in the coming Session be asked to pass legislation rendering it unlawful for foreign manufacturers to sell their goods in the United States below the cost of production.

Remote Control of Marine Engines.—According to the *Shipping Gazette*, it is reported that Dr. K. Ito, manager of the Mitsu Bishi engine works at Nagasaki, has invented and recently demonstrated the working of an apparatus which enables the navigator on the bridge of a steamship to start, stop, and regulate the main engines at will, without the intervention of human agency in the engine-room. The apparatus is worked by electricity, and can easily be disconnected if it is desired to control the engines in the ordinary way.

A Co-operative Society Electric Lorry.—We illustrate herewith a 30-cwt. electric lorry recently supplied by Messrs. Drake & Gorham, Ltd., of 47, Spring Gardens, Manchester, to the Blackpool Industrial Co-operative Society. The lorry is built on an Elison accumulator model "G. M." chassis, and equipped with an Edison battery capable of propelling the car for about 50 miles on one charge, the vehicle being rated to travel fully loaded at 11 miles an hour, although in practice the average speed has been

found to be well up to the legal limit of 12 miles an hour. The constructive details of this type of vehicle have been often referred to in our pages; in this particular case charging of the battery is effected from the Society's own gas-electric plant at its depôt. *The Blackpool Co-operative Pioneer*, in refering to this matter, expresses appreciation of the great simplicity of operation of the new vehicle as compared with the petrol-driven machine, and congratulates the members of the society on an acquisition which bids fair to save them money.

Foreign Trade.—Figures for October.—The following are the electrical and machinery figures given in the official returns for October:—

	Month of October.		*Inc. or dec.*	*Ten months, 1915.*		*Inc. or dec.*
Imports.	£		£	£		£
Electrical goods and apparatus, excluding machinery and uninsulated wire	86,769	+	26,789	852,897	−	236,295
Machinery ...	520,982	+	85,466	7,394,372	+	1,651,583
Exports.						
Electrical goods and apparatus, excluding machinery and uninsulated wire	245,840	+	32,843	2,516,107	−	81,280
Machinery ...	1,503,980	−	528,758	16,115,334	−	12,023,970

Fatalities.—South Shields.—At South Shields, on November 2nd, an inquest was held upon the body of Horatio Smith (31), electric welder, who was fatally injured on October 25th while following his employment with the North-East Coast Welding Co. George Rounding stated that on the date named he and deceased were welding boilers in the ss. *Hunterfield*, lying in Messrs. Brigham & Cowan's dry dock. They were using a portable generator which was at the side of the dock, the current being obtained from a trolley which worked a travelling crane. The current failed, and on going ashore they found the generator was not running. Deceased went forward to try it, but in doing so slipped from a rail on which he was standing into a pool of water, and then fell against the machine. Witness caught hold of his clothes and pulled him away. He was still alive but unconscious, and there was a burn on his neck. Artificial respiration was tried for an hour and a half without avail. Witness thought deceased received an electric shock before falling against the machine. William E. Groves, electrician in charge of the machinery, said that two men who went to assist deceased received shocks by standing on the rails. After the accident witness examined the cable and found a flaw in it, probably caused by contact with a hard substance. The cable passed over a pile of scrap chains, and he thought that the chains and the pool of water in which they were lying had become charged with electricity. Deceased had received a shock when he slipped into the water and another when he fell against the generator. Replying to Mr. W. B. Lauder, H.M. Inspector of Factories, witness agreed that at such places as the one where the accident occurred an armoured cable would be safer than one with the ordinary rubber covering. The jury returned a verdict of "Death from syncope, following an electric shock accidentally received," and recommended that cables should be more thoroughly protected at such places.

Hackney.—At the Hackney Coroner's Court on Saturday last, an inquest was held on the death of W. W. H. Gardiner, aged 28, of Cobden Road, Leytonstone, a telegraph wireman employed by the G.P.O., who died from injuries received owing to the collapse of a telegraph pole in the garden at the rear of a house in Mortimer Road, Kingsland, while at work removing wires.

W. Jones, foreman wireman, said that the pole broke off just below the ground line. It measured 40 in. in circumference where it broke. He had previously tried the post, and it appeared to be sound. The test was a hammer.

The lower section of the pole was produced in court, and appeared to be completely rotten.

C. E. Tattersall, sectional engineer in the G.P.O., stated that the pole was issued in 1902, and was probably erected 12 or 18 months later. The life of such poles was anything from 12 to 15 years.

The jury returned a verdict of "Accidental death," and added that in their opinion the examination of the pole before the man ascended it was hardly sufficient.

Gateshead.—A lad who climbed a lamp-post to extinguish an electric lamp when he heard that Zeppelins were coming touched a live wire and was killed.

Appointments Vacant.—Temporary shift engineers (£2), for Reading Corporation tramways; switchboard attendants (30s.-40s.), for Salford electricity department; switchboard attendant (27s.), for Wakefield electricity department; assistant shift engineer (42s.) and switchboard attendant (36s.) for the Battersea B.C. electricity department. Particulars are given in our advertisement pages to-day.

Volunteer Notes.—Engineering Institutions' Volunteer Training Corps.—Headquarters: Chester House, Eccleston Place, S.W. Orders for week commencing November 15th, 1915, by Lieut.-Col. C. B. Clay, V.D., Commanding.—

Drills, 6.25 to 7.25; 7.25 to 8.25.

Monday, November 15th.—Sections 1 and 2, Technical; Sections 3 and 4, Squad or Working Party.

Recruits and Signalling Section.

Tuesday, November 16th.—School of Arms with Architects' Corps, 6 to 8 p.m.

Thursday, November 18th.—Sections 3 and 4, Signalling Section, Shooting.

Friday, November 19th.—Sections 3 and 4, Technical; Sections 1 and 2, Squad or Working Party.

Signalling Section and Recruits.

Saturday, November 20th.—Uniform Parade, 3 p.m.

Sections for Technical Parade at Headquarters, London Electrical Engineers, 46, Regency Street. Sections for Shooting Parade at the Miniature Ranges. Unless otherwise ordered, all Parades at Chester House.

In future, and until further orders, Sections 1 and 2 will always Parade on Mondays for Technical, and on Fridays for Squad Drill, and Sections 3 and 4 will always Parade on Mondays for Squad Drill, and Fridays for Technical, but Sections 1 and 2 and 3 and 4 will alternate weekly for Shooting on Thursdays. Signalling Section will Shoot on the same days as Sections 1 and 2.

E. G. Fleming,
Company Commander and Acting Adjutant.

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, November 11th, 1915:—

Week-end Parades.—Saturday.—The Battalion will parade at Baker Street Station at 2.30 p.m., and proceed by train to Kilburn Station, where they will detrain and proceed by march route to Wembley Camp. There will be Night Operations from 5.15 p.m. till about 6.30 p.m. The Quartermaster will arrange for teas to be served punctually at 4.30 p.m.

Sunday.—The Battalion will parade at the Low Level entrance, Liverpool Street Station, at 8.55 a.m., and proceed by train for Entrenching duties, returning to Liverpool Street about 6 p.m.

The Quartermaster will make arrangements for Lunch.

Musketry.—Saturday 13th inst., and Tuesday, 16th inst.—Acton, at 2 p.m. punctually.

Bisley—Saturday, 13th inst.. as usual.

Sunday, 14th inst. There will be Targets for 500 yards and 600 yards all day. Members who have already sent in their names, should report themselves to Sergeant Cotter, at 9.45 a.m., at the barrier of No. 9 Platform, Waterloo Station.

A. G. Joiner, *Major and Adjutant*, O.B.C.

Railway Shunting Engine Telegraph.—An improvement in the means of communication between the shunters and the engine drivers has recently been tried on the shunting spur on the Great Western Railway, at Southall West Junction. In effect, the arrangement is a shunting telegraph between the neck of the spur and an engine on the spur, much after the fashion of a ship's telegraph between the captain's bridge and the engine-room. The transmitting instrument, situated at the neck of the spur, is electrically connected to two conductor rails fixed parallel to the running rails along the shunting spur. By means of the indicating instrument, the shunters are able to transmit six different signals to the engine driver, viz., "Go ahead," "Back," "Stop," "Steady," "Ease up," and "Back smart." The receiving instrument is fixed in the cab of the engine, corresponding signals appearing in front of the driver in the form of illuminated indications, which remain exhibited as long as desired by the shunters. A bell also sounds in the cab of the engine at the instant any signal is given or one ceases to be shown. The engine driver has, therefore, a constant visual indication of the shunter's requirements, and, in addition, has his attention called by a bell each time a change is made in the indication. To enable the signals transmitted by the shunter to be received in the cab of the engine, three shoes are fixed on the latter. Of these, only two make contact with the conductor rails at one time, the other only coming into operation when the engine is turned in the opposite direction. We understand that the arrangement has been found particularly useful in foggy weather, and that consequently its adoption in other shunting yards of the G.W.R. may be expected in the near future.

Institution and Lecture Notes.—The Röntgen Society.—In his presidential address from the chair of the RÖNTGEN SOCIETY on November 2nd, the new president, Mr. J. H. Gardiner, F.C.S., dealt chiefly with the historical side of modern investigation in physics and chemistry. Summarising progress so far as X-rays were concerned, he said that the little Crookes tube of 20 years ago, a laboratory-made scientific curiosity, had grown into the magnificent piece of apparatus which was known as the modern X-ray tube, an apparatus which with moderate care was practically indestructible, and through which could be passed with perfect safety 100 times the current that would utterly ruin the small one. The induction coil, except in a few instances a fragile machine rarely seen and still more rarely used, had given place to the modern high-tension transformer with its flaming torrent of sparks. The early radiographs of the hand, taken with great difficulty by four minutes' exposure, had given place to the magnificent radiograph of a thorax taken by a single flash, with a probable duration of 1/100th of a second. The X-ray, no longer an unknown form of energy connected with a series of more or less hazardous speculations, had fallen into place at the end of the series of electromagnetic vibrations, and the lengths of the waves had been measured and tabulated. The question of protection of X-ray operators from the harmful effects of the rays was a matter now being considered by the Society. There were such things as late X-ray reactions, occurring long after the use or application of the rays had been stopped, and it was evident that no one as yet knew all about the effects which X-rays produced. At the present time, X-ray installations were multiplying rapidly, and the work had of necessity to be done by those whose past experience was slight or was lacking altogether. In view of the serious results that might follow unless due care were taken, the President announced that the Council had, in the name of the Society, devised a set of suggestions for the protection of X-ray workers, and these would be supplied to all members and to as many public institutions as possible.

Institution of Civil Engineers of Ireland.—Mr. Mark Ruddle, city electrical engineer, Dublin, the newly-elected President of the Institution, delivered his inaugural address at Dublin last week, dealing in a comprehensive manner with some of the great issues—commercial, financial and industrial—involved in the war. He said it was probable that after the war there would be an exceptional demand for well-trained engineers in the reorganisation that would come with the industrial revival. The mind of the country was ready to receive new ideas, and to consider them without the tendency to prejudice that had fettered progress in times of peace. It rested with the members to develop the usefulness of the Institution, so that the benefits of its membership would be regarded as desirable by the engineering profession in Ireland. Mr. Ruddle remarked that this was the first occasion in the long history of the Institution that a member of the Electrical Section had occupied the chair.

Northampton Engineering College Engineering Society.—The arrangements for this session are not yet completed, but the Society will be carried on, as far as is possible, on the same lines as in previous years. The number of members of the Northampton Polytechnic Institute serving with the Forces is approximately 350; this number includes day students, evening students and members.

University College, London.—Mr. A. H. Barker, B.Sc., Lecturer in Heating and Ventilating Engineering at University College, will give a lecture on "The Methods of Evaluation of Standard Coefficients in Heating Engineering," in the Physiology Theatre at University College, on Tuesday, November 23rd, at 7 p.m. This lecture will be open to the public without ticket, and is especially intended for engineers and others concerned in practical work in heating and ventilating.

Institution of Electrical Engineers.—At the opening meeting of the SCOTTISH LOCAL SECTION, on Tuesday last, the new chairman, Mr. David A. Starr, delivered his inaugural address, the subject being "The Relation of the Electrical Industry to the War."

At the ordinary meeting of the Institution next Thursday, November 18th, a valuable collection of papers of Michael Faraday will be presented to the Institution on trust by Mr. D. J. Blaikley, who is the husband of the last surviving niece of Faraday.

Mr. P. V. Hunter, chairman of the NEWCASTLE-ON-TYNE LOCAL SECTION, on Monday delivered his inaugural address, the subject being power station switchgear.

Electrical Association of Australia.—At the meeting of the VICTORIAN SECTION on July 15th, a paper on "Electric Tramway Construction" was read by Mr. F. A. McCarty; and at the meeting on September 23rd, Mr. Douglas Little read a paper on "Overhead High-tension Transmission Mains."

A lecture on "Electrical Machinery" was given by Dr. G. W. Worrall to the Preston Mill Managers' Association on November 5th. The lecturer dealt with various defects in the construction of electrical machinery, and said these could be avoided by examination during construction by an expert acquainted with the conditions prevailing in the works which the machine was intended for. Dr. Worrall explained the great increase of efficiency and output brought about by electric driving.

Electric Heating and Electric Furnaces.—Continuing his lectures at University College last Friday, Prof. Fleming pointed out the advantages of dealing with the flow of heat through bodies in terms of resistance rather than conductivity, on the principle devised by Carl Hering, and showed how the usual conductivity constants could be utilised to obtain what could be called "thermal ohms." The construction of the integrating bolometer was then described: a sheet of platinum is sandwiched between sheets of silver, to enable the whole to be rolled out very thin; the silver is then dissolved off the platinum, and the latter is slit so as to form a grating, and is coated with platinum black by electrolysis, the result being the most sensitive device known for measuring radiant heat. The bolometer is calibrated by inserting it inside a globe of copper, which is kept at 0°C., whilst a concentric sphere inside it is kept at T°C., and the intervening space is exhausted of air. The path of the heat rays within the globe is therefore radial, and their intensity being known, the bolometer can be calibrated. Prof. Fleming explained the use of the bolometer for exploring the spectrum, and proceeded to demonstrate the use of the Féry radiation pyrometer, for measuring temperatures that were too high to allow thermoelectric or resistance thermometers to be inserted into the furnace. The importance of securing true "black body" conditions was emphasised; otherwise, the temperature would always be under-estimated.

Turning to the theories of heat and electricity, the lecturer remarked that although the atom was something like 10^{-8} cm. in diameter the electron was about 100,000 times smaller, or somewhat in the ratio of a pin's head to the dome of St. Paul's. On the electron theory, the electrons in copper were supposed to be about as numerous as the atoms, and the electric current consisted in a drift of electrons under the influence of an electromotive force. Thermal energy was due to the motion of the electrons, not the atoms, and as the energy of moving bodies was proportional to the square of their velocity, it could be shown that the energy developed by an electric current should be proportional to the square of the current strength, as in fact it was. But the resistance of pure metals, decreasing with temperature, appeared to become zero at the absolute zero of temperature, and, in the case of lead, Prof. Kamerlingh Onnes, reducing the temperature with the aid of boiling helium to within 4° C. of the absolute zero, found that its resistance actually became infinitesimal. This observation compelled a revision of the theory of conduction of electricity through metals, and Sir J. J. Thomson in August last propounded a new hypothesis to suit the facts. He assumed that the molecules of matter were electrically polarised like elementary magnets, and that the current was due to the arrangement of the molecules. This theory reconciled most of the phenomena of heat and electricity, and explained the anomalous behaviour of alloys, whose resistance did not tend towards the absolute zero as the temperature was lowered.

The third lecture will be given on November 19th.

Steel Wire for Russia: An Urgent Inquiry.—As we go to press a letter reaches us from a correspondent in Russia, who urgently requires large quantities of tin-plated steel wire of '23, '3 and '35 mm. diameter. He needs about 50,000 kilograms monthly, and wishes all the British factories turning out such wire to quote him lowest prices as speedily as possible, and give particulars as to earliest date of delivery. He wishes to have the information by cable. The wire required should have a breaking stress of 250 kilograms per square mm. If, however, the manufacture of such tough wire is impossible or difficult at the present time, he would accept it with a lower tensile strength, but in no case must it be below 120—150 kilograms per square mm. He suggests that if necessary the order could be divided among several factories. He also asks for catalogues, price lists, &c., giving particulars of various machines necessary for the production of copper wire and cables. Communications should be addressed to S. S. Mogipevcev, Moscow, B. Bronnaia, Dom No. 7.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Mr. T. K. RICHARDSON, station superintendent to the Marylebone electricity department, has been granted three months' leave of absence, owing to illness.

Mr. C. W. SALT, A.M.I.E.E., borough electrical engineer, Torquay, has joined the London Electrical Engineers (R.E.) for the period of the war. Business correspondence may be sent to Mr. J. M. Keenan, who will take charge of the electricity department in his absence. Personal letters may be sent to Mr. C. W. Salt, Glenside, Teignmouth Road, Torquay, for forwarding.

Tramway Officials.—The General Manager of the tramways at West Hartlepool having joined the Forces, the T.C. has placed the working of the system under the superintendence of the Electrical Engineer and the Borough Engineer.

General.—Mr. R. J. HEBBERT is leaving the measuring instrument department of Messrs. Siemens Bros. & Co., Ltd., at the end of November, in order to take up a position on the staff of the British Westinghouse Electric & Manufacturing Co., Ltd., at Trafford Park, Manchester.

The marriage took place at the Parish Church, Portobello, Edinburgh, on October 28th, of Mr. WM. WOOD, electrical and telegraph superintendent of the North British Railway, and Miss Lucy Laidlaw, daughter of Mr. John Laidlaw, of Portobello. The presents included a silver rose bowl from the chief officials of the railway company, a silver Queen Anne tea service from the electrical and telegraph staff, and a case of table silver from the railway electrical engineers of England and Scotland.

Councillor Albert Green, who is the new Mayor of Derby, is associated with the business of Mr. B. G. Hodges, electric wire manufacturer, of Derby, and with that of Messrs. T. H. Moon & Co., Ltd., electric wire manufacturers, of London.

In the *London Gazette* for November 5th the following appears:—Territorial Force.—Royal Garrison Artillery, Tyne Electrical Engineers. The undermentioned Second-Lieutenants to be Temporary Lieutenants:—Wm. A. Souter; J. F. S. Hunter; A. B. Williamson; J. R. Abbott; H. O. Rogerson; H. Sherlock; C. F. Scott; E. H. Gibbon; D. Myles; and F. B. C. Sutthery.

Mr. William H. Smith, who has been connected with Messrs. Simplex Conduits, Ltd., for a good number of years, has been appointed as manager to that company for Liverpool district and Ireland.

The Glasgow T.C. has appointed Bailie Alston convener of the Tramway Committee, with ex-Bailie W. M. Montgomery vice-convener, and Bailie Hannay as convener of the Electricity Committee, with ex-Bailie P. S. Stewart as vice-convener.

Mr. J. M. Ralph, chief of the testing department at the works of the British Thomson-Houston Co., Ltd., is leaving England for the benefit of his health.

Mr. Hughes Howells, who was in charge of the electrical plant of the Powell-Duffryn Co., Ltd., at Bargoed, has proceeded to the front for service with the Royal Flying Corps.

Mr. Benjamin G. Lamme, the chief engineer to the Westinghouse Electric & Manufacturing Co., Ltd., Pittsburg, has recently been appointed a member of the Naval Advisory Board, U.S.A. Mr. Lamme entered the employment of the American Westinghouse Co. in 1889, where for a period he occupied a post in the testing department; soon afterwards he took up design work, which he has since followed continuously. The American company appointed Mr. Lamme to be assistant chief engineer in 1900, and he succeeded to his present office in 1903. In the development of alternating-current apparatus, including induction motors, polyphase generators, rotary converters, and single-phase railway apparatus, Mr. Lamme has been in the front rank. He also performed pioneer work in the development of the first direct-current apparatus for railway lighting and power work. Among the more prominent installations with which Mr. Lamme has been identified may be mentioned the famous 5,000-H.P. revolving field Niagara Falls generators installed in 1895; the single-phase motor and generator equipment for the New York, New Haven and Hartford railroad; the Philadelphia-Paoli electrification of the Pennsylvania railroad, together with many other important installations.

Councillor F. A. Wardlow, deputy chairman of the Sheffield City Council Electricity Committee, and a director of Messrs. Edgar Allen & Co., steel manufacturers, has been elected Lord Mayor of Sheffield.

Mr. P. B. Smith, who has for more than three years been the outdoor representative of Messrs. Home & Rowland, electrical engineers, Charlton, London, S.E., has enlisted in the Royal Flying Corps.

Roll of Honour.—Private James Russell, of the 7th Battalion Lancashire Fusiliers, formerly employed at the British Westinghouse Works, Trafford Park, has been suffering from malarial fever, contracted at the Dardanelles, and is now on leave.

Private S. White, of the 8th Battalion Lancashire Fusiliers, who has died at the Dardanelles, aged 19 years, was formerly employed at the General Electric Works, at Salford.

Sapper Geo. Withington, of the Royal Engineers, who has been killed in action, was prior to the war engaged with Messrs. Brook, Hirst & Co., electrical engineers, of Northgate, Chester.

Pte. J. Crane, of the 2nd Border Regiment, who was engaged with Messrs. Browett, Lindley & Co., engineers, of Patricroft, has been recommended for the Distinguished Conduct Medal for conspicuous bravery on the battlefield on July 25th. Under heavy shell fire, he rescued a number of men who had been buried in a trench.

Pte. Sidney Geo. Stone, of the 2nd Worcestershire Regiment, who died from wounds received in action in France, was prior to the outbreak of war engaged with the British Thomson-Houston Co., Ltd., of Rugby.

Corpl. F. W. Green, of the 8th Berkshire Regiment, who was on the staff of the Reading Electric Supply Co., Ltd., has been killed in action in France.

Pte. Wm. Worrall, of the 1/6th Staffordshire Regiment, who was until his enlistment at the outbreak of war with Messrs. Siemens, of Stafford, has died from wounds received in action in France.

Obituary.—Mr. W. Alfred Restarick.—The death is announced of Mr. Wm. Alfred Restarick, assistant electrical overseer at Birkenhead Dockyard, and previously for 36 years on the electrical staff at Chatham Dockyard. He was 50 years of age.

Mr. Leonard Potts.—The death is reported of Mr. Leonard Potts, Town Clerk of Poplar, who acted as hon. secretary to the Conference of Metropolitan boroughs owning electricity undertakings.

Mr. P. A. B. Widener.—The death of Mr. P. A. B. Widener, the Philadelphian traction magnate, at the age of 81 years, is reported.

Captain D. R. H. P. Salomons.—We desire to tender to Sir David and Lady Salomons, of Broomhill, Tunbridge Wells, our sincere condolences in the loss of their only son, Captain David Reginald Herman Phillip Salomons, Royal Engineers, 3rd Kent Field Company (T.F.), who has been drowned at sea. The late Captain Salomons was born in 1885 and was an M.A. of Caius College, Cambridge. There is now no heir to the baronetcy. Sir David, who has always been intimately interested in electrical affairs, and who is at the present time president of the Electrical Trades' Benevolent Institution, may be assured that among a very wide circle of friends and admirers the deepest sympathy is felt with himself and Lady Salomons in their severe bereavement.

Lieut. N. G. Crompton.—We also tender our sympathy to Col. R. E. Crompton, of Thriplands, Kensington Court. Lieut. Nigel George Crompton, 89th Field Company, R.E. (attached 101st Field Company), the Colonel's younger son, was killed in action on November 5th. He was 27 years of age.

Colonel P. E. Huber.—On October 4th the well-known Swiss engineer, Colonel P. E. Huber, died at Zurich at the age of 79. He was the son of a silk manufacturer, and was educated at the newly-opened Polytechnic High School at Zurich, where he first acquired a bent towards mechanical engineering. After a short period with Sulzer's at Winterthur, and Escher, Wyss in Zurich, as well as further studies in England and Belgium, in 1863 Huber founded an iron-works in partnership with an Englishman called Jackson, under the style of P. E. Huber & Co., at Oerlikon, but it went into liquidation a few years later, and in 1872 passed over to another company in which Huber held a share. The latter in 1876 became the Oerlikon Machine Tool & Engine Works. As first president of the board of management, and later general manager, he soon brought the company up to a high standing, added iron and brass foundries and steel works, and in the middle eighties established an electrical department. A striking performance carried out by the Oerlikon Works, in conjunction with the A.E.G., in 1891, was the construction of the famous power transmission from Lauffen to the electrical exhibition at Frankfort-on-Main. Up to 1894 Huber was managing director, and from then to 1911 president of the board of management, of the Maschinenfabrik Oerlikon, and from 1911 to his death he continued to be a member of the board. In addition to bringing the Oerlikon works up to their present high state of efficiency, Colonel Huber took an active interest in several other undertakings, such as the Neuhausen Aluminium Co., of whose board of management he was president for many years, and the Society of Swiss Enginebuilders, of which he was chairman from the commencement. He was a man of high character, great gifts, strong will, and good breeding, who possessed in equal measure broad views and commercial foresight and prudence.—E.T.Z.

NEW COMPANIES REGISTERED.

Telephone Manufacturing Co., Ltd. (142,023).—This company was registered on November 2nd, with a capital of £25,000 in £1 shares (10,000 7 per cent. cum. pref.), to take over the business carried on by F. T. Jackson as the "Telephone Manufacturing Co.," to carry on the business of making, selling, hiring out, buying, putting up, maintaining and working (so far as they lawfully can) private and other telephones and telegraphs, etc. The subscribers (with one share each) are: F. T. Jackson, Hollingsworth Works, Martell Road, West Dulwich, S.E., manufacturer; A. Stocken, 49, Leadenhall Street, E.C., solicitor. Private company. F. T. Jackson is permanent governing director. Registered office: Hollingsworth Works, Martell Road, West Dulwich, S.E.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hong-Kong Tramway Co., Ltd.—A memorandum of satisfaction to the extent of £200 on September 7th and £300 on September 20th, 1915, of trust deed dated July 1st, 1903, securing £195,000, has been filed.

Bracuhy Falls and Metallurgical Syndicate, Ltd. (110,780).—Capital, £48,000 in £1 shares. Return dated December 30th, 1914 (filed June 4th, 1915). All shares taken up. 10s. 6d. per share called up; £25,200 paid. Mortgages and charges: Nil.

Chili Telephone Co., Ltd. (29,252c).—Capital, £360,000 in £5 shares. Return dated July 28th, 1915. 66,000 shares taken up. £220,000 paid; £110,000 considered as paid. Mortgages and charges: Nil.

Crompton and Co., Ltd. (129,649).—Capital, £221,007 in £1 shares (136,000 pref.). Return dated July 19th, 1915. 79,539 ord. and 136,000 pref. shares taken up, of which 2,240 pref. have been forfeited. £1 per share called up on 7 ord. and 7s. 6d. per share on 133,760 pref; £50,788 2s. 8d. paid (including £621 2s. 8d. paid on 2,240 pref. shares forfeited); £163,132 considered as paid, being £1 per share on 79,532 ord. and 12s. 6d. per share on 133,760 pref. Mortgages and charges: £100,000 first mortgage debentures.

D.P. Battery Co., Ltd. (44,084).—Capital, £10,000 in £1 shares (4,996 "A," 4,996 "B," and 8 others). Return dated July 21st, 1915. All shares taken up; £10,000 paid. Mortgages and charges: £12,000.

Bray, Markham and Reiss, Ltd. (74,871).—Capital, £20,000 in £1 shares. Return dated July 15th, 1915. 9,250 shares taken up; £8,850 paid; £400 considered as paid. Mortgages and charges: Nil.

W. A. and R. J. Jacobs, Ltd.—Particulars of £1,000 debentures, created October 23rd, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £300. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Electro-Flex Steel Co., Ltd.—Issue on October 26th, 1915, of £200 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Auckland Electric Tramways Co., Ltd.

Mr. C. G. Tegetmeier presided, on Monday, over the annual meeting of the company, held at Electrical Federation Offices, Kingsway. In proposing the adoption of the report, the Chairman, after referring to the absence on active service of Capt. Leo Myers, a director, said this was the first time since the company started electrical running in 1902 that they had not been able to point to an increase, and generally a large increase. The war had affected their business in Auckland, but a comparison with the previous year might be somewhat deceptive, because in that year they had the traffic brought about by the Auckland Exhibition to increase their receipts, and, on the other hand, the discontinuance of running for 18 days during the strike. It was probable that the operation of those two causes upon their gross revenue was to counterbalance each other. The present accounts covered a period of 11 months of war-time, and closely following upon the outbreak of hostilities there was a noticeable decline in the volume of traffic. The tendency in that direction became more pronounced as the year went on, and it was still continuing. The more conservative policy adopted by the local authorities with regard to public works, the restriction of building operations, the lessened attendance at the various places of amusement, and the almost entire absence of interest in football and other athletic sports, were all contributing causes. In view of all the adverse circumstances they had had to meet, it could not be expected that their receipts would show the same expansion as under normal conditions. The total traffic receipts showed a decrease of £3,908, the whole of which arose in respect of the motor omnibuses. The motor 'buses were acquired specifically for the purpose of facilitating the exhibition traffic, and they proposed to dispose of them as soon as a suitable opportunity could be found. Power and running expenses amounted to £112,091, or a reduction of £6,039. That was mainly accounted for by the lessened cost of coal as compared with the abnormal cost in the previous year, due to the strike. The running costs were somewhat higher, owing to the fact that a considerable proportion of the men were paid on a sliding scale, increasing with length of service, and to a larger number of them attaining the maximum rate of pay. The increase in the rate for the year was about 2½ per cent., the average rate paid to motormen at the end of the year being very nearly 1s. 3d. per hour, and to conductors close upon 1s. 1d. per hour. Those rates indicated the difference in the labour conditions prevailing in New Zealand and in this country, and they could quite realise that it required a very high average of receipts to enable them to pay such wages. On repairs and maintenance they had spent £38,851, £2,820 more than in the preceding year; and in addition they spent £22,545 upon renewals, the larger portion on the reconstruction of the permanent way. The latter amount was charged to the renewals and depreciation account, which had been created specially to meet such expenditure. A good deal of reconstruction work had still to be carried out upon the earlier constructed lines. During the past year they had restricted reconstruction expenditure to work that was immediately necessary, and they were still pursuing that policy. A time came, however, when it was false economy to postpone reconstruction, and it was essential that their renewals account should be adequate to meet the expenditure when the need arose. Out of last year's revenue they were allocating £22,500 to the renewals and depreciation account. The net result of the year was that the balance available for distribution was £1,221 less than last year. The dividend upon the preference shares at £9,000 was unaltered, and they proposed to pay the same dividend of 1s. 7d. per share for the year on the ordinary shares, but it would be paid less income-tax, instead of free of tax as they had done for the past three years. The effect of deducting the income-tax from the ordinary dividend was that the amount charged for rent, rates, and taxes was £3,562 less than if the dividend had been paid as usual. It was, unfortunately, the case that the company had to pay English income-tax upon the whole of its profits, notwithstanding the fact that they were earned exclusively in New Zealand and were heavily taxed there. That was one of the many anomalies in connection with our income-tax law that pressed very hardly upon companies such as theirs, and which, in its ultimate effect, must be detrimental to the interests of the State. It was so far satisfactory to know that the Chancellor of the Exchequer recently stated that on the very first opportunity after the war the Government would devote themselves to making a reform in our income-tax laws, so perhaps they might look forward to some redress in the future. On the whole, he thought they had good reason to congratulate themselves upon the results shown, and there was no reason to doubt that when the war was over, and the end we were fighting for was attained, the progressive prosperity of the company would be resumed.

Col. Burton seconded the motion, which was carried unanimously.

Monterey Railway, Light & Power Co.

In a circular to the debenture-holders the directors state (says the *Financial News*) that, owing to the low rate of exchange prevailing between Monterey and London, it continues to be impossible for the company to provide the interest on the debenture stock. While the directors regret that they do not see any action that can usefully be taken in the interests of the debenture stockholders, they are ready and willing to co-operate with the debenture stockholders in any course thought advisable in the common interests. There is not now any court in Monterey exercising civil jurisdiction whose assistance could be sought in connection with the company's or the debenture stockholders' affairs. The financial statements for 1914 are being prepared, and will shortly be presented to the shareholders for their annual meeting. The trustees, in a circular, say that in the existing conditions they feel that taking any proceedings might greatly prejudice the best interests of the company and the debenture stockholders.

Edison & Swan United Electric Light Co., Ltd.

The directors report that for the year ended June 30th, 1915, after providing for interest on both classes of debenture stock, and depreciation upon freehold properties and plant, there is a net profit of £14,147, plus £5,732 brought forward, making a total standing to the credit of profit and loss of £19,879, which the directors propose to deal with by transferring to reserve account £15,000, and carrying forward £4,879. As previously pointed out, it is absolutely essential in the interests of the company that a substantial reserve account be created and, for this reason, the directors regret that they are unable to recommend the payment of a dividend upon the shares. The increased turnover of the business, coupled with the rise in the cost of all raw materials and labour, have severely taxed the capital resources of the company during the past year, and additional working capital is required in consequence. This can only be provided out of profits, therefore the directors recommend the allocation of the amount standing to the credit of profit and loss as above. The accounts show that marked progress has been made during the year, and the results would probably have been still more satisfactory had it not been for the abnormal rise in the price of raw materials, labour, and carriage. Whilst on the engineering side of the works this extra cost has been partially met by a corresponding rise in selling values, the lamp side of the works has been materially affected, and, it being impossible to raise the selling price of drawn-wire lamps, the increased cost of manufacture has materially reduced the profit on sales. In spite of the difficulties attending the shipment of goods for abroad, the directors report that the export business, particularly to the British Colonies and India, has shown a marked increase, and they look for considerable development in this direction when times become normal. A resolution will be submitted to the annual meeting on November 18th for the purpose of electing to the board Mr. John Cross, who represents parties holding a considerable interest in shares of the company, and the board trust that shareholders will support this.

Australia.—According to the "Melbourne Age," the financial statement of the Hydro-Electric Power & Metallurgical Co., Ltd., covering the period of five months ended July 31st last shows an addition of £1,790 to the debit at profit and loss, which thereby is increased to £200,665. The outgoings for the term were £2,135, whilst income amounted to only £345. The directors state that the agreement with the Tasmanian Government stipulates for a supply of up to 10,000 H.P., as required, from time to time, with provision for still further blocks as may be wanted. Plans and estimates for the working unit of the electrolytic zinc plant are being prepared.

Buenos Aires Port and City Tramways Co., Ltd.—The accounts for the year to December 31st, 1914, have been issued, also further accounts made up to June 18th, 1915, on which date a receiver was appointed by the court. These show an operating profit of £6,191 for the five and a-half months, as against accrued interest on debentures, £13,781; sinking fund, £2,592; and interest on loans, £2,340. The directors are not able to say whether a scheme of reconstruction will be formulated by the receiver or by the debenture-holders; but it is hoped that some proposal may not be long delayed which will be duly submitted to the shareholders.—*Financial News.*

Metallic Seamless Tube Co., Ltd.—The report for the past year states (says the *Financial Times*) that the net profit was £3,415, and £4,349 was brought forward. A dividend of 20 per cent., free of income-tax, is proposed, adding £3,000 to reserve, and carrying forward £1,612.

British Ever-Ready Co., Ltd.—The directors have declared a dividend at the rate of 10 per cent. per annum on the preference and ordinary shares for the half-year to September 30th.

British Electric Traction Co., Ltd.—A petition for confirming the reduction of capital from £4,000,000 to £2,998,398, is to be heard on November 16th before Mr. Justice Astbury.

United Electric Tramways of Caracas, Ltd.—The *Financial Times* states that the directors' report for the twelve months ended June 30th, 1915, states that the directors, following the precedent of last year, consider it desirable that profits should as far as possible be again fully divided among the shareholders. The local company were therefore requested to declare, as last year, a dividend absorbing the whole of their net profits. After adding the balance forward, £1,206, the net revenue shows a disposable balance of £15,749, out of which the directors recommend a dividend for the year of 7 per cent. and a bonus of 1½ per cent. (less income-tax), which will absorb £14,450, leaving £1,299 to be carried forward. The profits of the local company (the whole capital of which is owned by this company) have been adversely affected by the European war, and it only requires the re-establishment of peace to enable the company to resume its prosperous career. The percentage of operating expenses is 51.38, which is 3.10 per cent. more than the previous year, due to the larger mileage run with less receipts.

Cleveland Trust, Ltd.—Explaining the causes of the smaller profit of the Cleveland Trust, Ltd. (Middlesbrough), at the annual meeting on Monday, Mr. W. H. Hustler (vice-chairman) said that one immediate cause was the unfortunate result of the war upon their electric lighting undertaking at Saltburn-by-the-Sea. They had been adversely affected in this respect a year ago, and he was afraid they would not have to look for profit from that source so long as the lighting restrictions continued. A dividend of 5 per cent. was declared.

"Z" Electric Lamp Manufacturing Co., Ltd.—A petition for confirming the reduction of capital from £150,000 to £15,000 is to be heard on November 16th before Mr. Justice Astbury.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended August 27th, 1915, amounted to 2,051,304, compared with 1,501,589 in the corresponding four weeks of 1914; and during the five weeks ended October 1st the number was 2,618,836 units, compared with 1,811,089 in the corresponding five week of 1914.

Nairobi Electric Light and Power Co., Ltd.—At an extraordinary general meeting, held on Wednesday at the offices, 30, Mark Lane, E.C., Sir Stanley Edwards presiding, a resolution was passed increasing the capital of the company from £30,000 to £50,000 by the issue of 20,000 new ordinary shares of £1 each.

Cape Electric Tramways, Ltd.—Dividend 5 per cent., less tax.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange business keeps good. It is necessary to explain that the word is used more or less relatively, but instead of about 25 per cent. of the members of the Stock Exchange paying their office expenses, the proportion during the past fortnight has probably risen to twice as much. It may be replied that the latter performance is not particularly brilliant, but, anyway, the stockbroker comforts himself with the reflection that things are not so bad as they were.

The Home Railway market is one of the firmest. Throwing off its long-protracted depression and stagnation, it has suddenly assumed a place amongst the progressive markets, and its prices have gone ahead in a fashion somewhat bewildering to those who do not appreciate how very small an amount of demand or supply is needful nowadays to bring about quite substantial movements in prices.

Other things, however, are also good. Peace rumours are said to lie at the root of the advance; perhaps the verb is appropriate, because nobody believes that Germany is so far exhausted as to sue for peace yet. At the same time, the Stock Exchange opinion favours the idea that the latest Serbian diversion, dreadful as it is for our heroic little ally, is scarcely more than a fresh flounder of the crippled giant in his net, and a desperate struggle to place his precarious footing in a position secure enough to enable him to treat for peace with the expectation of getting better terms than he could possibly hope for by simply taking the present Eastern and Western fronts into account.

The investor goes on buying shares day by day, and, it seems surprising to note, the spirit of speculation is beginning to revive. People are once more anxious to get as many shares as they can for as little money as possible; and the readiness to take risks argues that there is plenty of capital available. In the United States, gambling in stocks and shares goes on apace, and the economists look askance at the huge quantity of British gold which is being imported into the country, and which experience teaches will have the effect of accelerating gambling, and raising the prices of commodities, with everything else.

Electricity markets are feeling the changed conditions of business principally through the medium of the Brazilian-Canadian-Mexican group of securities. In Mexicans, the halt which was called last week is still operative, although the strength of most of the stocks and shares connected with the country is surprisingly well maintained. Another hiatus has occurred in the receipt of news from Mexico, so that nobody quite knows what is happening there. The Monterey Railway, Light & Power Co. has notified its debenture stockholders that the collapse in exchange has rendered it impossible to transmit funds to Europe, except at a loss. The directors, therefore, consider it best to let earnings accumulate until normal conditions are restored, and we take it that proprietors will raise no objection to such a course. Brazilian utility bonds are good, and one of the features of the week is a forward movement in most securities connected with Brazil.

Canadian issues move irregularly. New York operators put down prices on Monday last upon the publication of the terms of the United States Note to this country. There stood a group of Stock Exchange men discussing the Note, and one of them clinched the tenour of the argument with the remark that it was surprising what a lot of letters answered themselves if they remained long enough in the pocket. There is a good deal of amusement in the Stock Exchange at the tone of the American Government's demands.

The London Supply Companies show a dullish front, so far as the market in them is concerned. The market is not even assisted by the remarkably small falling-off displayed in the electric lighting bill of the City Corporation in respect of the latest period for which the figures are announced. The ratepayer in various parts may wonder why the lighting authorities do not put in smaller lamps, which consume less current and give subdued illumination, rather than continue to take a full supply of current, and to obscure the glass. From the shareholder's point of view, the latter is doubtless the more excellent way; but from the economical aspect, the former looks preferable, on the face of it. We understand that the important London companies are holding joint meetings, with a view to finding some system whereby one could help another should it become necessary in the case of fire.

Half-a-dozen falls have taken place in the leading ordinary and preference shares. Kensington ordinary and St. James' preference have both declined to 6. Westminster ordinary and St. James' ordinary are each 6¼. There are a few shares on offer in this group, and, as we have noted before, buyers require a good deal of tempting before they will put money into electrical supply shares nowadays.

The telegraph division is firm. A little speculation sprang up in West Indian and Panama shares, buyers giving 23s. 6d. for them, induced thereto by the dividend announcement already mentioned here in our two previous issues. Globe ordinary and preference have repeated their previous rises of ¼. Eastern ordinary and Western shares are both better. New York Telephone bonds remain at 100, at which they are too dear.

Substantial improvement in Anglo-Argentine Tramways issues is the principal feature amongst the foreign list. The three debenture issues of both classes of preference shares have advanced, the latter class showing a rise of 5s. apiece. Confidence is steadily returning to the Argentine Republic, and it is argued, justifiably enough, that the Anglo-Argentine Tramways securities make good speculative investments. Taking the quintet of stocks which we quote, it will be noticed that the average return runs out to 6¾ per cent. on the money. At last week's prices, it would have come to a little over 7 per cent.

At the Auckland Electric Tramways meeting, held on Monday, the chairman referred to the harsh incidence of the income-tax upon profits in the concern, pointing out that the company had to pay very heavy taxes in New Zealand and, at the same time, further taxes on this side. This is one of the many cases in which there would seem to be room for useful modification—at any rate, when peace is restored.

Babcocks are strong at 2¼, regaining twice as much as they lost last week; the shares are being bought from the provinces, where investors usually know what they are doing. Castner-Kellners are also firm; and it may be mentioned, incidentally, that the 4½ per cent. debenture stock changed hands early this week at 96½, at which it seems distinctly expensive. Henleys are better at 12¾, but Callenders are called lower at 10¼. The improvement in Telegraph Constructions is continued, the price rising another 10s. to 33¼.

The rubber market is decidedly good. Business is active, and many of the leading shares are keeping pace with the price of the product as it steadily hardens. The Armament group, too, is slightly better, though business remains quiet. There is further strength amongst copper shares, due to the American demand for the copper stocks popular on the other side.

In *Harper's Magazine* this month a writer on "The City of the Future" declares that, by then, "Synthetic rubber has arrived. The city traffic is entirely electrical. Trucks and motors speed swiftly without odour or noise; they are charged with power at the great central station in off-peak hours. Cooking is done on electric stoves. Electric trains have annihilated space. Balanced by gyroscopes, they speed at 200 miles an hour on a single rail." It is a little depressing to learn, after all this, that in man there is little left that is elemental, and that the laughter of children is more rare.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Nov. 9, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	7½	—	£6 18 4
do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	3½	—	7 2 10
do. do. do. 4½ Pref.	4½	3½	—	6 0 0
do. do. City Pref.	4½	3½	—	6 8 7
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4½	—	5 17 8
do. 4½ Deb.	4½	87	—	5 3 6
City of London	9	12½	— ¼	7 7 3
do. do. 6 per cent. Pref.	6	10½	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10	—	7 0 0
do. do. 6 per cent. Pref.	6	10½	—	5 17 8
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	83 xd	—	5 8 0
Kensington Ordinary	9	6	— ¼	7 10 0
London Electric	4	1⅝	—	8 8 4
do. do. 6 per cent. Pref.	6	4½	— ½	7 1 2
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	8½	2½	—	7 15 7
do. 4½ per cent. Pref.	4½	3½	—	6 0 0
do. 4½ Deb.	4½	85	—	5 6 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6½	— ½	7 13 10
do. do. do. 7 per cent. Pref.	7	6	— ½	5 16 8
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1⅞	—	6 14 0
Westminster Ordinary	9	6½	— ½	6 18 6
do. 4½ Pref.	4½	4½	— ⅛	5 9 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	101 xd	—	5 18 0
do. Def.	1½	23	+ ½	6 10 5
Chile Telephone	8	6½	—	6 8 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11½	—	*6 16 2
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord.	7	123	+1	*6 18 0
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	82	—	4 18 0
Globe Tel. and T. Ord.	6	10½	+ ⅛	*6 13 9
do. Pref.	6	10½	+ ⅛	5 17 1
Gt. Northern Tel.	22	33½	—	6 11 4
Indo-European	13	46 xd	—	6 18 4
Marconi	10	1⅞	—	6 8 0
New York Tel. 4½	4½	100	—	4 10 0
Oriental Telephone Ord.	10	1⅛	—	5 8 1
do. Pref.	6	⅜	—	6 17 2
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5⅝	—	*8 2 6
do. Pref.	5	4⅛	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12⅜	+ ⅛	*6 9 4
do. 4 Deb.	4	80	—	5 0 0
Home Rails.				
Central London, Ord. Assented	4	68	—	5 16 0
Metropolitan	1½	25½	+3½	4 18 0
do. District	Nil	14½	+1½	Nil
Underground Electric Ordinary	Nil	1⅜	+ ⅛	Nil
do. do. "A"	Nil	5/-	+3d.	Nil
do. do. Income	6	71½	+1	*9 6 3
Foreign Trams, &c.				
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	97	—	5 3 0
Anglo-Arg. Trams, First Pref.	5½	8⅞	+ ½	7 6 8
do. 2nd Pref.	5½	9¼	+ ½	8 9 2
do. 4 Deb.	4	75½	+1½	5 6 0
do. 4½ Deb.	4½	75	+1	6 0 0
do. 5 Deb.	5	76	+1	6 11 7
Brazil Tractions	5½	57½ xd	—	6 1 9
Bombay Electric Pref.	6	10½	—	5 17 1
do. 4½ Deb.	4½	87	—	5 8 0
Mexico Trams	Nil	84	—	Nil
do. 5 per cent. Bonds	—	50	—	Nil
do. 6 per cent. Bonds	—	44	—	Nil
Mexican Light Common	Nil	30	—	Nil
do. Pref.	Nil	40	—	Nil
do. 1st Bonds	—	20	—	—
Manufacturing Companies.				
Babcock & Wilcox	14	2½	+ ⅛	6 4 5
British Aluminium Ord.	5	1⅛	—	4 14 1
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	10½	—	7 8 2
do. Pref.	6	5½	—	5 2 2
British Westinghouse Pref.	7½	84/-	—	8 10 8
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	10½	— ½	7 2 10
do. 5 Pref.	5	4½	—	5 11 8
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	61/-	—	4 18 6
Edison & Swan, £8 pd.	Nil	10/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	57	—	7 0 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/9	—	7 1 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	12⅜	+ ⅛	*8 19 4
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	7⅞	—	6 5 0
Telegraph Con.	20	33½	+ ½	*8 8 3

*Allowance made for dividends being paid free of income-tax.

Amazon Telegraph Co., Ltd.—The gross revenue for the year ended June 30th, 1915, amounted to £57,933, and the working expenses to £34,938. After providing £22,888 for debenture interest and sinking fund, there remains £107, plus £5,840 brought forward, making the balance to be carried forward £5,947.—Annual meeting: November 16th.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 10th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a „ Nitric	„	..	..
a „ Oxalic	per lb.	1/1	1d. inc.
a „ Sulphuric	per cwt.	..	..
a Ammoniac Sal	„	..	..
a Ammonia, Muriate (large crystal)	per ton	£50	..
a Bleaching powder	„	..	..
a Bisulphide of Carbon	„	£23	..
a Borax	„	£23	..
a Copper Sulphate	„	£35 10	£7 10 inc.
a Lead, Nitrate	„	..	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
c Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	..	..
a Potash, Caustic (88/90 %)	per ton	..	..
a „ Chlorate	per lb.	1/4½	..
a „ Perchlorate	„	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers	„	£11 10	..
a „ Recovered	„	..	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/73 %)	„	..	..
a „ Chlorate	per lb.	1/3½	..
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	6½d.	1d. inc.
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	..	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	..	..
b „ Sheet, in ton lots	„	..	..
e Babbitt's metal ingots	„	..	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/1 to 1/1½	½d. inc.
c „ Tubes (solid drawn)	„	1/1½ to 1/2	½d. inc.
c „ Wire, basis	„	1/1½ to 1/1⅔	..
c Copper Tubes (solid drawn)	„	1/1½ to 1/2	½d. inc.
g „ Bars (best selected)	per ton	£107	£4 inc.
g „ Sheet	„	£107	£4 inc.
g „ Rod	„	£107	£4 inc.
d „ (Electrolytic) Bars	„	£91	£2 10 inc.
d „ „ Sheets	„	£109	£2 10 inc.
d „ „ Rods	„	£98	£2 10 inc.
d „ „ H.C. Wire	per lb.	11 11/32d.	5/32d. inc.
f Ebonite Rod	„	5/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/7½	2d. inc.
f Iron Pig (Cleveland warrants)	per ton	67/7½	..
f „ Wire, galv. No. 8, P.O. qual.	„	£26	..
g Lead, English Pig	„	£25 15	..
g Mercury	per bot.	£16 15	20/- inc.
e Mica (in original cases) small	per lb.	6d. to 8/-	..
e „ „ „ medium	„	8/6 to 6/-	..
e „ „ „ large	„	7/6 to 14/- & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	..	..
p „ „ rolled bars & rods	„	..	..
p „ „ rolled strip & sheet	„	..	..
o Platinum	per oz.	198/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	„	£162 to £163	£7 10 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/7	..
p White Anti-friction Metals	per ton	..	..
k Zinc, Sh's (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

The Belgian Buenos Aires Tramways.—It is stated that the Compagnie Générale de Tramways de Buenos Aires, of Brussels, will be unable to pay any dividend on the ordinary shares this year, this result contrasting with a distribution of 6¾ per cent. a year ago. The omission is attributed to the circumstance that the Anglo-Argentine Tramways Co., which is said to be controlled by the Belgian company, carried forward the whole of the net profits of £96,000 earned in 1914 in order to meet, as occasion might arise, the company's obligations in regard to the holders of the 5 per cent. cumulative preference shares of the first and second series. It is true that the Belgian company owns 189,612 preference shares of the first series and 399,531 of the second, but the dividends resulting therefrom only render it possible for the company to defray, besides the general expenses, the interest and redemption charges on its loans, which absorbed £91,000 in 1914.

DECIMAL COINAGE AND THE METRIC SYSTEM.

(*Continued from page 582.*)

Probably in no branch of industry would the benefits of the metric system be more marked than in engineering works. To begin with, drawings would be figured in millimetres throughout, and there would be no necessity to mark feet and inches, with the constant liability to error that at present exists through the confusion of ticks with figures. How easily 1′ 1¼″ can be mistaken for 11¼″ or 1 11¼″; or 1 3/16 can become 13/16, and so on. How many errors are made in adding up a series of dimensions containing eighths, sixteenths, and thirty-seconds. How long does it take to find, say, 23/32 on the rule? If calculations have to be made, fractions must often first be reduced to decimals, or voluminous tables be consulted. It is sometimes argued that mistakes may easily be made in placing the decimal point; more often than not, no decimal point is required, but if a mistake is made it is so great—tenfold—that the error is generally obvious. For instance, suppose the gauge of a railway were given as 14.3 metres, or 143 metres, instead of 1.43 m. (=4 ft. 8½ in.). Who would be misled? Similarly, suppose the length of a rail were stated as 90 m. instead of 9 m.—would the error not be obvious? The liability to error would not be even as great as under present conditions. The ease of taking out quantities, which has been already mentioned, would confer an enormous gain upon draughtsmen.

It might be anticipated that difficulty would be experienced in getting workmen to adopt the metric system. This, however, has been proved by actual experience to be an unfounded belief. Messrs. Willans & Robinson have for years used the metric system for their foreign trade, side by side with British measures, and no difficulty has been experienced; they have adopted the metric system also for the manufacture of steam turbines. No new tools were necessary on account of the adoption of the metric system. Again, the Baldwin Locomotive Works, U.S.A., made 20 locomotives for a French company to metric measures; 19,000 American workmen were affected, and were enthusiastically in favour of the metric system. The Paris-Orleans Railway Co. furnished the drawings, 500 in number, representing 10,000 different parts; the work was to be done in six months, and it was impossible to make new drawings. In a few days six draughtsmen working on the locomotives, and four on the tenders, had got out the shop drawings; the company purchased metric standards, made metric gauges and templets, and supplied the men with metre rules graduated to millimetres. The dimensions were all in millimetres, without any reference to the old system. Not a mistake was made, and the work was satisfactorily accomplished. There was no trouble with the men, and the superintendent of the works, Mr. S. M. Vauclain, was converted to the metric system.

The limit-gauge system, so extensively employed in engineering works nowadays, is independent of the system of units; it is immaterial to the workman whether his gauge is exact millimetres or inches—he need not know its dimensions at all. In either case the dimensions are almost certain to be expressed in decimals. Lathes, milling machines, boring machines, etc., need no alteration at all for use with the metric system; templets are easily altered, if necessary, but how often would any alteration be required? In any case, templets wear out, and have to be replaced. It is easy to alter bushings in jigs. Few measurements, except those where an exact fit is required, are accurately worked to, so that the elaborate calculations sometimes put forward to show the difficulty of expressing British standard dimensions in millimetres are beside the mark; usually the nearest millimetre is sufficiently accurate. Carpenters and joiners are not particular to an eighth, and in pattern-making rule-of-thumb allowance for shrinkage would swallow up many millimetres. Standard screw-threads, unless over 1 inch in diameter, are rarely cut in the ordinary lathe; they are cut with taps and dies which are of fixed dimensions, and it does not matter in the least that they will, no doubt, continue to be cut to inch standards. British Association Standard threads, adopted by the Standards Committee, are tabled only in metric units—rare foresight!—but we never hear of any trouble due to the confusion between inches and millimetres. Metric micrometers are conveniently made with two revolutions per millimetre, reading to 1/100 mm.; but inch micrometers have to be made with 40 revolutions to the inch, and 25 divisions to the circle, or some such awkward arrangement involving much mental effort and liability to error. The 1/100 mm. is a finer and therefore better unit than the 1/1,000 inch, which is 2½ times as coarse.

As for engineering calculations, the advantage is so enormously on the side of the metric system that it is hardly worth discussing. In the design of electrical machinery it is far easier to convert all the British measurements into metric units, work out the calculations, and convert back again, than to adhere to the British measures. This is indeed a common practice in electrical work. The opinion of Mr. C. P. Steinmetz, the distinguished American mathematician and engineer, is worth quoting in full. At the commencement of a paper on the "Steam Path of the Turbine," read before the American Society of Mechanical Engineers, he says:—

"In the following, the metric system of units will be used throughout, since the incongruous mixture of heterogeneous units, called the English system, requires so many reduction factors, that it can conveniently be used only in a narrow range of mechanical calculations, by memorising reduction factors; but where the investigation extends over several branches of science, as mechanics, thermodynamics, and electrical engineering, the English system is so cumbersome, that it is far simpler to translate the premises into the metric system, carry out the work in the metric system, and translate the result back into the English system, if so desired."

Sir Frederick Bramwell has often been quoted in favour of the existing system, which, he claimed, was the best for mental arithmetic; but he possessed altogether exceptional powers in this respect, and it is a poor argument that, because he was proficient in mental arithmetic, we should put up with the innumerable disadvantages of the British units. Moreover, he mistook the metric system for the decimal system. Users of metric units are in no way tied to the use of decimals; they use vulgar fractions whenever these suit their purpose better, and they claim the use of Sir Frederick Bramwell's short cuts as well as their own. On the other hand, Sir Benjamin Baker, an engineer of no less eminence, and of great experience in the use of the metric system, said that the latter was "incomparably simpler"; the difference was "simply marvellous!"

No English engineer can possibly object to the metric system on the score of "a string of decimals"; on the one hand, he already uses the mil, or thousandth of an inch, habitually, and on occasion expresses his dimensions in ten-thousandths—four decimal places! The same measurements can be expressed in millimetres and decimals to three decimal places only, to a higher degree of accuracy, and to two decimal places with a degree of accuracy which cannot be exceeded in practical work (4/10,000 in.), except in the very finest operations.

It would seem advantageous to give an actual example of a working drawing figured on the metric system, for the purpose of comparison with the

English system, as probably few of our readers have seen or had occasion to prepare two such drawings; we therefore reproduce a drawing which is given in Prof. Follows's "Dictionary of Mechanical Drawing" as an example of the best way of dimensioning a drawing, in terms of feet and inches, and the same drawing with the same dimensions translated into metric measures. Although the latter are taken to only one place of decimals, 18 out of the 28 different dimensions are correct to less than one mil (one-thousandth of an inch); 24 are correct within two mils; and of the remaining four, two are just over two mils too large, whilst the other two, which are of no consequence whatever (being the radii of

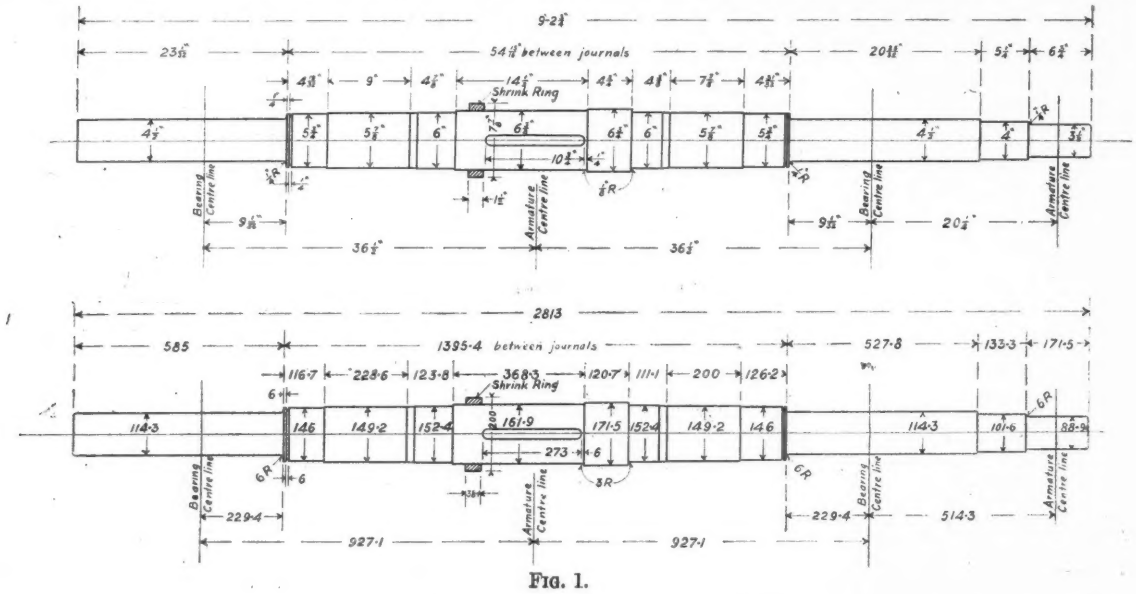


FIG. 1.

fillets), are only taken to the nearest millimetre, and, therefore, are respectively .007 and .014 in. too small. Disregarding these fillets, there is not a single dimension where a fit is required which is as much as one mil inaccurate, and not a single dimension which is as much as .0021 in. out. To prove these statements, we give a table showing the inch measurement, the metric equivalent to thousandths of a millimetre, the figure used on the drawing, and the resulting error expressed in terms of the inch. We believe this comparison is worth careful study,

Dimension in inches.	Equivalent in mm.	Approx. equiv. in mm.	Error in inches.
4½*	114·298	114·3	+ ·00008
5⅝	146·048	146·0	— ·00189
5⅞*	149·223	149·2	— ·00090
6	152·397	152·4	+ ·00012
6⅛*	161·922	161·9	— ·00087
6¾	171·447	171·5	+ ·00209
4	101·598	101·6	+ ·00008
3½*	88·899	88·9	+ ·00004
4 19/32	116·679	116·7	+ ·00083
9	228·596	228·6	+ ·00016
4⅞	123·823	123·8	— ·00090
14½	368·293	368·3	+ ·00028
4¾	120·648	120·7	+ ·00205
4⅜	111·123	111·1	— ·00090
7⅞	200·022	200·0	— ·00087
4 13/32	126·204	126·2	— ·00016
10¾	273·045	273·0	— ·00177
1½	38·100	38·1	0
23 3/32	584·983	585·0	+ ·00067
54 15/16	1,395·386	1,395·4	+ ·00055
20 25/32	527·833	527·8	— ·00130
5¼	133·348	133·3	— ·00189
9 ft. 2¾ in.	2,813·049	2,813·0	— ·00193
9 1/32	229·390	229·4	+ ·00039
20¼	514·340	514·3	— ·00158
36½	927·083	927·1	+ ·00067
¼	6·350	6	— ·014
⅛	3·175	3	— ·007

* Dimension to fit other part of machine.

if only to refute the common but groundless argument that the metric equivalents necessitate "a string of decimals." We may mention that the thousandth of a millimetre is much used in measurements of high precision, as of the wave-length of light, and is called the micron; one mil (1/1,000th of an inch) = 25 microns.

The reason why the inaccuracy due to taking the nearest tenth of a millimetre never exceeds about 2 mils, and averages about 1 mil, is obvious; the greatest error that need be incurred is 50 microns, which is less than 2 mils. If greater accuracy were needed, it would never be necessary to use more than two places of decimals, as this would give the equivalent a maximum error of ¼ mil, and an average error but little exceeding one ten-thousandth of an inch. In the case of the four dimensions that must fit other parts, one is the diameter of the journals, and happens to be right to less than the ten-thousandth part of an inch, though a whole mil would not matter in this instance. The other three should be close fits; one of them is almost exact, the others both show a deficiency of nearly one mil, and might with advantage be taken to the second decimal place.

It will be noticed that Prof. Follows uses such dimensions as 36½ in. and 9 ft. 2¾ in. on the same drawing. This, however, is nothing to what can be done in inch measurements, as we shall show; but before leaving this drawing, we commend to the notice of our readers the series of dimensions which must add up to 54 15/16 between the journals, and invite them to *perform the addition*, first in inch measurements, and afterwards with millimetres. The latter we have done mentally with ease; we defy any reader to add up the inch measurements in the same way, without a mistake, in twice the time. There is nothing exceptional about the drawing, which was selected merely for convenience, as a typical case, and without the slightest regard to the values of the dimensions.

(To be continued.)

Ozonair. — MESSRS. OZONAIR, LTD., have recently received a further order from the London Electric Railway for "Ozonair" plant. The present installation is destined for the Leicester Square station of the Charing Cross, Euston and Hampstead Tube, where it will be in operation shortly. It constitutes the 17th installation supplied to the London Tube Railways by Messrs. Ozonair, Ltd., and this testifies to the success and popularity of their system of purifying air by the addition of small quantities of pure ozone, which can be applied equally to the factory, the office, or the home.

THE RELATION OF SCIENCE TO PRACTICE IN ENGINEERING.

DEALING with this subject as President of the LIVERPOOL ENGINEERING SOCIETY, PROF. E. W. MARCHANT delivered an interesting address, of which the following is an abstract:—

It is to the application of scientific method and the development of technical instruction that Germany owes the position she has attained in engineering constructional work during the past 20 years. There is little doubt that if we are to retain the pre-eminent position we have occupied in engineering manufacture and construction, it will be necessary for us to work by scientific methods, and, by applying the scientific knowledge we have gained of the quality and strength of material, to cheapen and improve the construction of engineering work. To illustrate the effect of scientific study in one direction only, it is sufficient to compare the cost of electrical plant with what it was 20 years ago. A normal figure for static transformers was £2 10s. per KW., now, a large transformer can be built for 10s. per KW. This reduction in price is due to two things; the discovery of alloyed steel, which has a much higher electrical resistance than ordinary transformer iron, and magnetic qualities very little inferior, which has enabled a smaller iron section to be used; and, secondly, to the scientific study of the most effective method of getting rid of the waste heat, which has enabled an enormous increase in the size of unit to be effected.

The laboratory attached to a college or university has usually limited facilities for large scale engineering research; it must deal in principles and theories, which are really fundamental. Researches of this kind naturally divide into three groups:—

1. Investigation of the properties of materials used in engineering.

2. Investigation of apparatus and machines, their origination and design.

3. Investigation of a more physical kind on new phenomena, with a view to their development for practical use.

All these fields of research are vast in extent, and their exploration is only begun.

1. The essential material for electrical engineers is copper, which forms a considerable percentage of the weight of all electrical machinery. The quality of greatest importance is its electrical conductivity, and it is interesting to note that all the copper used nowadays for electrical purposes is of 2 or 3 per cent. better conductivity than the purest copper Mathiessen could produce in his laboratory. The improvement in this material has been due entirely to the careful scientific study of its properties, and to the application of electrolytic purification in the final stages of manufacture. The study of copper conductivity showed that the presence of a very small amount of impurity was sufficient to cause a decrease of conductivity out of all proportion to its amount. For example, traces of arsenic reduce the conductivity by 40 per cent., 0·1 per cent. of phosphorous reduces the conductivity by 30 per cent. Such facts as these showed the way in which the highest conductivity could be obtained. Copper of high tensile strength also (30 tons per sq. in.) is very common with small wires. A similar study is now going on with aluminium, a metal of which the mechanical qualities are comparatively poor, and the result already has been to place aluminium in the field as a serious rival of copper for many purposes. This has partly been due to the reduction in price caused by improved methods of manufacture, which, in turn, are due to the results of scientific investigation, but also to the study of methods of preparing the metal, so that it shall not be corroded by exposure.

The effect of scientific investigation on the manufacture of iron and steel for electrical purposes has already been referred to. A new alloy of silicon and iron called "Stalloy" was produced, as the result of researches by Barrett, Brown and Hadfield on the conductivity and permeability of iron alloys in January, 1900. These researches give us a particularly interesting example of the advantage of co-operation between the manufacturer and the man of science. The work undertaken was a scientific investigation of the properties of iron alloys, in which different substances, tungsten, nickel, manganese, silicon and aluminium, in known proportions, were alloyed with steel. The materials were produced at the Hecla Works of Sir Robert Hadfield at Sheffield, and tested in Prof. Barrett's laboratory at Dublin. The surprising effect of a small percentage of silicon on the electrical conductivity of the iron and on its magnetic softness was the result of greatest interest. It is no exaggeration to say that no other discovery has done more to reduce the size and improve the operation of electrical machinery than this one has done.

The effect of alloying with tungsten pointed to a method of producing a hard steel for permanent magnets. This, and the other important uses to which tungsten could be put, led the Germans to take up tungsten manufacture, and when the war broke out nearly all the tungsten used in tool steel and magnet steel was proved to be of German origin. This position has now been changed, and thanks to the complete control we possess over the supply of tungsten ores, the manufacture of tungsten has been undertaken by the manufacturers here on a large scale, with the result that all the tungsten wanted for magnets and tool steels can be obtained. This result has been achieved not by direct Government action, but by the enterprise of our manufacturers.

Germany has not captured our trade in magnet steel, the steel made in Sheffield is better and harder than any that can be got anywhere else in the world. And we are not standing still. The investigation of the magnetic property of steel is a subject which is now being undertaken by a Committee of the Institution of Electrical Engineers, working in conjunction with the manufacturers, notably Sir Robert Hadfield's firm, and it is hoped that the results of the investigations now being undertaken may prove as useful as those which have been obtained from the earlier experiments.

The discovery of sludging in transformer oils led to the scientific study of the properties of oil, with the result that at the present time, oil manufacturers will undertake to provide oil which will produce no perceptible "sludge" or deposit, after hundreds of hours of heating in contact with copper, even when air is blown through the oil to oxidise it.

The use of high-frequency current has opened up a wide range of investigation on the properties of material, which will require a large amount of time and patient study before the materials can be used to the best advantage.

2. One of the most outstanding examples of the assistance that scientific investigation has given to the construction of electrical machinery is the working out of the principle of the magnetic circuit, by the late Dr. John Hopkinson. Dynamos had been constructed by Edison and others in America and elsewhere, but it was not until Hopkinson had pointed the way to an economical design of the magnetic circuit that any very rapid progress was made.

An example of what scientific design and experiment may accomplish has recently come to my notice through the activity of one of my students. I refer to the practical monopoly that Germany had obtained in the manufacture of magnetos. When the war broke out a company was formed, and Mr. Watson worked out the design of a good magneto. The manufacture was not a mere copy of that which had previously come from Germany; it was worked out on scientific lines, and the result was a machine superior to that which had formerly been imported from Germany. The firm, which is now making 250 machines a week, is extending its works rapidly, and will soon be turning out from 1,000 to 1,500 machines per week, mostly for the British and Allied Governments. This is an excellent example of what may be done by scientific organisation and the use of scientific knowledge. A great deal remains to be done in this direction. A colleague of mine who spent some years with Siemens & Halske, in Berlin, told me that he was one of the staff of a dozen or more technical graduates who spent their whole time testing and experimenting with a line of A.C. motors that the firm was turning out, to see whether it was possible to improve their design and increase their rating. It is to work of this kind that the marvellous progress of German industry is largely due.

Every electrical machine of the present day is an example of what scientific study can produce.

Prof. Miles Walker described at the British Association meeting at Manchester, just recently, a new device he has produced, as the result of experiments in his laboratory, which has enabled him to obtain 1,500 KW. from a rotary converter of only 500 KW. rating, a further advance brought about by scientific investigation.

It is perhaps in the development of machinery and apparatus for the production and use of high-frequency currents that scientific investigation has found, within recent years, its most effective application. The mathematical investigation of Kelvin first showed how high-frequency currents could be produced in an electrical circuit, consisting of a condenser and a coil of wire; the discovery of Hertz, that these oscillations would produce electric waves, was first made possible by the classical electromagnetic theory of Clerk Maxwell, the gradual evolution of this idea to practical ends by Marconi and others led to the design of sparking circuits which can handle and control discharges having an average power of 500 or 1,000 KW., and these discharges are now in regular use for wireless signalling across the Atlantic. The discovery of Duddell that continuous electrical oscillations could be produced by the electric arc and the development of this discovery by Poulsen have led to the design of the "Poulsen" generators, which now develop over 200 H.P., and are used for sending messages from San Francisco to Honolulu. But perhaps the most remarkable instance of the utility of scientific method has been the application of loading coils for increasing the distance over which an audible telephone message can be sent. The idea of using self-induction to improve the speaking capacity of a cable was first suggested by Heaviside as the result of a mathematical analysis. The application of Heaviside's principles by Pupin (a man of Servian nationality) and the installation of Pupin's loading coils has made it possible to send a telephone message from New York to San Francisco; whereas 20 years ago it was thought almost beyond the powers of practical telephone engineers to speak from Holyhead to Dublin.

3. One of the most remarkable developments which has taken place during the past few years has been the equipment by such firms as the General Electric Co., of America, of testing and research laboratories, which are really laboratories of applied physics, and which do not attempt to make themselves of direct use in the testing and examination of electrical or other machinery.*

Dr. Langmuir, the director, states that:—"The laboratory is continually conducting researches of a purely scientific nature. These investigations may be initiated because of their scientific interest without any definite object in view, but every marked advance in science has resulted sooner or later, directly or indirectly, in important effects on industry, and these laboratory investigations have nearly always had practical results." The gas-filled lamp, or "half-watt lamp," had its origin in the result of an academic study of the laws governing the loss of heat in small wires. The metallised lamp resulted from experiments with a

* An illustrated description of these laboratories appeared in the ELECTRICAL REVIEW of October 22nd, 1915.

high-temperature vacuum furnace. He adds, however, "that it does not follow that all important achievements of the laboratory have thus been brought about. Many of them are the results of persistent resourceful effort directed from the beginning towards a perfectly definite goal."

One of the most remarkable instances of the application of scientific investigation in industrial purposes that I have seen recently is the application of high-tension electric discharge to the precipitation of dust.* This process, the application of which to the dispersal of fog was first suggested by Sir Oliver Lodge, is now being applied to the purification of blast-furnace gases, to the precipitation of aluminium oxide, to the precipitation of starch dust, sugar dust, and coal dust, and an attempt is being made to apply the process to the destruction of black smoke.

Reference has already been made to the development of wireless telegraphy; in this connection the more physical type of investigation is of the greatest value. The investigation by Fleming of the so-called "Edison Effect," in which he showed the unilateral conductivity between a heated filament and a metal plate enclosed in an exhausted bulb, has been used extensively for detecting signals sent across the Atlantic at Clifden, and in many other wireless stations; it has given us one of the most reliable detectors for this purpose that we have, one that is uninfluenced by atmospheric discharges. This principle has been used in the valves which seem likely to provide telephone engineers with a satisfactory relay, a thing for which they have been vainly searching for years.

If, as seems probable, laboratories for investigations of this kind spring up and develop in connection with many large manufacturing firms, scientifically-trained men will be required to man them. It is one of the functions of the universities and technical schools to supply these men. It is in this direction that there should be the closest co-operation between the engineering schools of the country and the manufacturing firms. The students of universities and colleges are well adapted by their training to occupy positions in such laboratories; but if they are to be obtained, they must receive some financial encouragement.

The war has proved to us that the Germans have made enormous industrial progress, and it has opened the eyes of a good many people who had failed to appreciate the rapidity of their progress. Though I do not wish to hold out as the universal panacea for all industrial evils a closer relation between science and practice in engineering manufacture, I believe that a great deal is possible by a more intelligent appreciation of the benefits that scientic study and investigation can confer on industry. That, in itself, is not enough. In order to enable the manufacturer to equip and maintain such laboratories it will, I believe, be necessary for him to receive protection in some form for his products.

We must be prepared, after the war is over, for a fierce and unscrupulous war of commerce, not only with Germany, but with other countries less highly developed. It will take us all our time, with all the political advantages we hope to gain, to maintain our place in the world's markets. We shall have a powerful commercial competitor in America, a competitor who will not have suffered the devastating capital losses we are suffering through this war. We shall have to use to the full our scientific knowledge, so as to save every penny that we can of unnecessary expenditure in material, or in labour. The manufacturers, as I have already explained, are realising this fact. The Government has already established a Research Council, and, it is to be hoped, may also assist by supporting the institutions which supply the raw material of scientific development.

THE INSTALLATION AND WORKING OF STORAGE BATTERIES.

On November 2nd, Mr. R. Rankin, B.Sc., M.I.E.E., read a paper before the Association of Supervising Electricians presenting a great deal of practical information on the problems of lead accumulator working. Probably the very fact that this subject is often considered hackneyed and rather below the notice of an engineer is chiefly responsible for unsatisfactory results, where these are obtained. It is quite wrong to regard a storage battery as a sort of necessary evil; it deserves and repays careful attention; it is not beneath the notice of an engineer, although it has no wheels about it; and when a battery gives trouble it is generally due to faulty manipulation. Unless a battery is large enough for its work and is regularly inspected it is bound to give trouble. By insisting upon a 100 per cent. maintenance-of-capacity guarantee one can be sure that the battery is of adequate capacity, and the extra cost of a battery room accommodating all the cells in one tier is repaid by the resulting easier inspection and more efficient maintenance. If the cell lugs be bolted together, the bolts must be tightened at frequent intervals, and where wooden separators are employed these should not be placed against the positive plates, otherwise, by impeding acid circulation at this point, they lead to corrosion of the positives.

It is an easy matter almost to ruin a battery by carelessness during the first charge. Charging should be continuous and prolonged until all the cells show constant voltage and specific gravity. If filling with acid takes some time, care must be taken that those cells first filled are completely charged. Cost of energy is of no importance as compared with the importance of a thorough first charge. The latter may occupy 40 to 60 hours, and as it should be continuous for 24 hours at least, it is inviting trouble to start charging from a new generating set without making sure that the latter is in perfect electrical and mechanical adjustment. The charging current must be reduced if the cell temperature reaches 100° F., and, after charging is apparently complete, half the normal charging current should be continued for six hours or so. The specific gravity may not show constancy on completion of charge, unless allowance be made for its being reduced 1 point (water = 1,000) per 3° F. temperature rise above 60° F.

When a battery is first placed in service it should not be worked too heavily for a time, and during the whole of its life its discharge should be reckoned according to the subjoined table. The figures there included show the marked reduction in capacity of cells at heavy discharge rates, and the minimum cell voltages specified must be observed. In this connection the Rankin battery control instrument is particularly useful; there are two pointers, one indicating the actual average voltage per cell, and (on another scale) the total battery voltage; the second indicating the battery discharge current and the permissible minimum voltage per cell which is dependent on the rate of discharge. If the positions of the two pointers coincide, the battery must be re-charged, or the rate of discharge reduced, for the actual cell voltage has reached the minimum permissible at the existing rate of discharge.

Duration of discharge in hours.	Capacity in terms of maximum.	Rate of discharge in terms of 10-hour rate.	Minimum permissible p.d. per cell.
10	1·00	1·00	1·83
9	·98	1·09	1·83
8	·95	1·19	1·83
7	·92	1·31	1·83
6	·88	1·46	1·83
5	·83	1·67	1·83
4	·78	1·95	1·80
3	·72	2·39	1·80
2	·63	3·17	1·78
1	·50	5·00	1·75
·75	·45	5·84	1·70
·5	·37	7·45	1·70
·25	·22	8·95	1·70
Peak	—	12·50	1·60

Complete reliance should never be placed on any instruments in battery working. Intelligent personal supervision is imperatively necessary. A very small error, certainly one within the range of everyday experience, in a battery switchboard voltmeter may lead easily to persistent over-discharge and under-charge, with the result that cells are soon brought into a hopeless condition. It is false practice to give always a certain percentage excess of charge over discharge (as indicated, say, by ampere-hour meters), because the efficiency of charging depends greatly on the charging rate. The familiar "10 per cent. excess" rule is entirely wrong, as will be seen from the following consideration. If the ampere-hour efficiency of a battery be x per cent., the overcharge required is $100(100 - x)/x$ per cent., and if $x = 90$ per cent. (which is the maximum sound guarantee figure) at least 11·1 per cent. overcharge is needed, and though this may suffice at the normal charging rate, probably 15 per cent. excess will be needed when charging at a rate 50 per cent. in excess of normal.

Whilst charging at excessive rates is generally recognised to be inefficient and injurious, it is less often realised that cells cannot be properly charged at very low rates. The negative plates are charged, but the positives are simply sulphated, corroded and buckled. This danger is particularly to be guarded against where milking boosters are used; the latter should give the full normal charging current.

Distilled water is best, but is not indispensable for topping-up purposes. If it be proposed to use other local supply, a sample should be sent to the battery manufacturers for approval. Iron is injurious to the negatives and chlorine to the positives, which it corrodes violently. Near the coast, rain water is charged with salt from the atmosphere, and must therefore not be used for topping-up. Water added should be introduced at the bottom of cells by aid of tubing, and preferably during the last stages of charging when gassing facilitates mixing. Corrosion is favoured by accumulation of dilute electrolyte on the surface.

The log sheets kept so religiously in most accumulator installations are of more than doubtful value. Their compilation entails a vast amount of labour and pains unless, of course, a certain practice not unknown amongst attendants is followed, in which case the log sheet is worse than useless. To overcome these several objections, Mr. Rankin suggests a very workmanlike method of control and record keeping. Unless it is very small, the battery is divided into four sections, and in each section a pilot cell is chosen. The latter is given special attention to ensure that it is a true index of the state of its section. The current flowing, voltage, and specific gravity are logged for the pilot cells at the end of each charge and discharge. During a weekly or fortnightly short gassing overcharge, readings are taken at 15-minute intervals on the pilot cells after gassing commences, in order to make sure that charging is really complete; at the same time all the cells are inspected to see that they begin gassing at the same time as the pilot cells, and gas to the same extent. Any sick cell thus discovered should be nursed and full particulars should be logged concerning the defect and its cure. All ordinary troubles are covered, in so far as they

*See Electrical Review, May 14th, 1915.

are not eliminated, by this simple system of regular inspection and careful logging of an absolute minimum of data. The elimination of special troubles generally needs the experience of a specialist armed with an auxiliary electrode in addition to the ordinary cell-testing equipment.

If a battery is to remain idle for several months, it is best to arrange for charging it at suitable intervals, but if it is to remain out of service for a year or more it should be dismantled by the following means:—After charging every cell completely, discharge the battery at the 5-hour rate to 1·5 volts or less per cell, thus forming a protective skin of sulphate on the negatives (which are the vulnerable part). Care should be taken that no cell reverses during this unusually complete discharge. When discharged the cells should be emptied, covered over and kept clean. A first charge is required when the cells have again to be placed in commission.

THE TRAINING OF AN ENGINEER.

As President of the Birmingham Association of Mechanical Engineers, Mr. A. E. A. Edwards delivered an inaugural address in which he drew attention to three features of an engineer's training which did not usually receive sufficient attention:—

1. The commercial side of the business.
2. The control of men.
3. The power of speech.

There were doubtless others, but here they had three features which were essential to turn a sound technical man into a successful engineer.

To put the matter in a nutshell, an engineer was usually taught the *profession* instead of the *business* of engineering.

An apprentice was not ordinarily admitted into any of the routine of the commercial side of the business; he knew nothing about correspondence or of getting out costs, or of preparing estimates, or of the value of an hour's work by different machine tools, or of the art of selling. This work was often entrusted to men who had no technical engineering training, and the young engineer, to whom this information would be invaluable, was rigorously shut out of those departments on the false assumption, perhaps, that he would learn too much of the firm's business.

If a firm undertook to teach an apprentice engineering, and received money for doing so, they should give him some knowledge of the commercial side of the business, for that was the side which was of first importance. A successful business man said he could get a man skilled in all the technical engineering knowledge required for his business for £500 a year, but that he would give £5,000 a year for a first-class commercial man.

There were some engineering establishments in which it was a practice for every draughtsman to take out his own quantities and make up his own estimate. To do this, it was necessary for the draughtsman to see the foremen of the smiths, boilermakers, fitters and turners, and pattern makers, and to obtain from them an estimate of the time each of the leading items required. Such a procedure gave the draughtsman a chance of altering his design, possibly to suit the processes of manufacture as pointed out by the foremen, instead of such alterations being delayed until the first machine had been made.

Observation proved that comparatively few engineering apprentices rose to the eminence their technical skill merited, because they had not the requisite knowledge of how to manage men. The large and increasing number of industrial disputes was undoubtedly due to the want of tact in the management.

Many industrial disputes arose simply from the fact that large limited companies tended to make the management impersonal, and the men felt, in fact, they knew, that their only remedy was to "come out." There was still far too much distrust between capital and labour.

In the shops of the General Electric Co., he was told, they put an apprentice on a job, and left him at it until he could make his successor at the same job competent to do the work, and thus they had in operation a scheme which helped a youth, at any rate, to be lucid in his explanations, and which gave him some trifling idea of management. Quite trifling, he admitted, but it was just the method to allow a youth to assimilate the elements of management, and he was certain to make later on, other things being equal, a better manager than, say, a University-trained man who had been pitchforked into a manager's job without having been previously brought into really intimate contact with men, and, consequently, without being able to appreciate their point of view. There were, doubtless, men who were born leaders, but these were in a very small minority. The majority of successful leaders had learnt how to lead through hard experience, and had passed many pitfalls on the way.

Probably the reason why America could afford to pay higher wages than we, and yet could undercut us in our own markets, was the fact that her organisation was better.

An efficient co-operation must consist of a controlling head, and a body that obeyed. Discipline was its most essential attribute. Unless we one and all ceased to try to live without a discipline which presupposed leadership, we were doomed to sink into a third-rate people of mediocrities or worse.

All great businesses, all great nations were built up by leaders of men, with others to help by loyal obedience: true union, true co-operation.

Lastly, an engineer was not likely to rise above quite a subordinate place unless he could place his thoughts and ideas readily before those to whom he was speaking.

In order to gain support for his schemes, a man must possess the ability to gain personal confidence and to lead others in the right direction by thoughtful consideration of their prejudices. If he was not able to be their elementary schoolmaster in technical matters, they would search for knowledge among friends, manufacturers' salesmen, or consulting engineers, and would form opinions of their own, which were likelier than not to be wrong ones owing to imperfect knowledge of the requirements of the case.

An engineer's ordinary training required no speech at all, whether in the shops or office, and in this respect it differed from the training required for almost any other business, in which speaking to clients or customers was part of the daily routine. It was, on this account, of more importance to the engineer to take every opportunity of learning to express his thoughts and ideas, which few of them could do clearly without the aid of a pencil or a piece of chalk. Their Association, and all other similar societies throughout the country, formed a means, close at hand, for engineers who wished to practice this essential part of their training.

There was no other trade or profession in which the articled apprentice at the end of his time was rated so low as in engineering, and the reason appeared to be that an engineer's training was at present based on altogether wrong lines. He was not concerned so much that night about the training of men whose sphere of life was to be that of a mechanic as in those youths whose parents payed a high premium for their engineering training, in the vain hope that this training would fit them for some reasonably remunerative post at the conclusion of their apprenticeship.

There was no more necessity for a man of this class to be a first-rate handicraftsman than there would be for a doctor to be specially skilled in washing patients, or a printer expert in setting up type, or a brassfounder adept in pouring metal. A premium apprentice should know much of the manual side of the business, but his training should extend to the commercial side, to the elements of management, and to learning how to clothe his ideas with words.

It was in this direction that our universities and our works and civil engineers should train those who payed to be trained. No one who appreciated the value of money should pay a premium simply that his boy might have the privilege of learning to be a mechanic or a draughtsman, or even to have him instructed at a university in the principles and practice of *technical* engineering alone.

The usual qualifications required of a manager were that he should have commercial experience, be a good organiser, and be of good address. This was the class of man always wanted. There was a demand for them that was never satisfied. Why not train apprentices first in these qualifications, instead of keeping their noses to the grindstone and attempting to grind them into mechanics or draughtsmen, and making them so that they would fit that groove and no other all the days of their life?

THE STAVE FALLS POWER DEVELOPMENT.

In a paper recently read before the Canadian Society of Civil Engineers, by Mr. R. F. Hayward, some particulars were given of the Stave Falls power development of the Western Canada Power Co. The latter concern has the right to store water in Stave Lake and develop 50,000 h.p. there, and to develop a similar amount of power at the mouth of Stave River.

The company is the riparian owner of practically the whole margin of the water from the upper end of the lake to the mouth of Stave River.

Constructional work on the Falls plant for an ultimate capacity of 50,000 h.p. commenced early in 1910, and a standard gauge railway six miles long was built to transport machinery to the site.

The first installation, consisting of two 9,000-kw. units, was put into commission in January, 1912, and in 1913 contracts were placed for the third and fourth 9,000-kw. units, and it became necessary to provide for the construction of a second plant on the Stave River within a few years' time.

The power house at Stave Falls was laid out for four 13,000-h.p. turbines, mean head of water 110 ft., and two 500-h.p. exciter turbines. The double horizontal Francis type of turbine was chosen for the large power, and single-runner machines for the exciters, the turbines being supplied by Messrs. Escher, Wyss & Co.

The author remarks that had the plant been designed three or four years later, the vertical type of single-runner Francis wheel would without doubt have been adopted, not only be-

cause of its higher efficiency, but because it would have saved money on the power-house.

The turbine casing is 18 ft. dia., built of ¾ in. steel plates, with a cast-steel end plate designed for a thrust of nearly 1,000 tons, which may come upon it when the governor suddenly shuts the gates under full load and head. The runners are 63 in. diameter, of steel plate cast into steel hubs, and the bearings are water-cooled, 15¾ in. in diameter.

The area of the draft tube gradually increases, so that the velocity of the water is reduced from 14.6 ft. per second at the top to 6.3 ft. per second at the bottom.

The governor is of the hydraulic type, operating with oil at 300 lb. per sq. in. pressure, supplied from a central pumping plant through a ring pipe system.

The turbines were built on a guarantee of 83 per cent. efficiency at full load and 110 ft. head, and have developed 10,000 KW. electrically, under 107 ft. head.

The generators, exciters, and transformers were supplied by the Canadian General Electric Co. The generators are three-phase, 60-cycle, 4,440-volt machines rated at 8,825 K.V.A., with 40 deg. C. rise, and 11,031 K.V.A. with 55 deg. C. rise. The exciters are each of 250 KW. capacity, and there are twelve 3,000-KW. water-cooled oil-insulated transformers arranged in three banks to step up from 4,400 to 60,000 volts.

The oil switchgear for 60,000, 12,000, and 4,000 volts was supplied by the Canadian Westinghouse Co.; the 60,000-volt switches and bus-bars are contained in reinforced concrete chambers, with the 4,000-volt switches in a room above, and lightning arresters on the roof.

From the tail race level to mean tide level at the mouth of the Stave River the total fall is 134 ft., and while a single development of this power near the mouth of the river would be quite economical for the full capacity of plant, the initial cost would be high, as the dam alone would cost a million dollars. As it is important that expenditure on future construction should not be made further in advance of actual demands than necessary, a plan is being considered of developing two plants, each to work with 65 ft. head.

These would use single-runner vertical turbines of 10,000 to 12,000 H.P., and the company can increase its plant in accordance with the demand up to a total of 120,000 H.P.

IMPORT TRADE OF CHINA.

THE following figures, showing the value in 1914 of the net imports into China, from foreign countries, or electrical and similar goods, are extracted from the Returns of the Imperial Maritime Customs. Comparative values for 1913 have been added, and the increases or decreases noted:—

	1913. Hk. Tls.*	1914. Hk. Tls.†	Inc. or dec. Hk. Tls.
Copper.—			
Bars, rods, sheets, plates, and nails	258,000	585,000	+ 327,000
Ingots and slabs	6,130,000	6,658,000	+ 528,000
Wire	189,000	187,000	− 2,000
Rails	896,000	554,000	− 342,000
Sleepers	1,446,000	2,996,000	+ 1,550,000
Belting, machine	268,000	278,000	+ 10,000
Cement	608,000	901,000	+ 293,000
Electrical materials and fittings	2,322,000	2,726,000	+ 404,000
Scientific instruments and apparatus	740,000	872,000	+ 132,000
Lamps and lampware	1,356,000	1,069,000	− 287,000
Machine tools	50,000	96,000	+ 46,000
Engine oil	708,000	985,000	+ 277,000
Telegraph and telephone materials	719,000	567,000	− 152,000
Locos. and tenders	769,000	2,515,000	+ 1,746,000
Railway carriages and wagons, including tramcars	1,194,000	2,223,000	+ 1,029,000

* Average value of Haikwan Tael in 1913 = 3s. 0¼d.
† Average value of Haikwan Tael in 1914 = 2s. 8¾d.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

15,057. "X-ray apparatus." E. E. GREVILLE. October 25th. (Addition to 21,609/14.)

15,081. "Joint for electric light fittings, particularly applicable to portable electric lamps." H. J. C. FORRESTER (J. W. Dunham, U.S.A.). October 25th. (Divided application on 2,489/15, February 16th.) (Complete.)

15,082. "Portable lamps or other portable devices." H. J. C. FORRESTER (J. W. Dunham, U.S.A.). October 25th. (Divided application on 2,489/15, February 16th.) (Complete.)

15,083. "Portable electric lamps." H. J. C. FORRESTER (J. W. Dunham, U.S.A.). October 25th. (Divided application on 2,489/15, February 16th.) (Complete.)

15,094. "Attachment for miners' electric safety lamps for detecting fire-damp and other combustible gases." T. J. THOMAS. October 26th.

15,104. "Electric lock and lighting appliance for miners' safety lamps." W. PRICE. October 26th.

15,106. "Electric clocks and electric time-indicators." R. KENNEDY. October 26th.

15,113. "Dynamo-electric machines adapted for synchronous working." L. J. HUNT & SANDYCROFT, LTD. October 26th. (Addition to 24,838/14.)

15,128. "Electric indicators." P. M. LINCOLN. October 26th. (Convention date, November 12th, 1914, U.S.A.). (Complete.)

15,142. "Machine for making insulators." P. SIMONSEN. October 26th. (Convention date, November 13th, 1914, Denmark.) (Complete.)

15,143. "Pressure die for insulator-pressing moulds." P. SIMONSEN. October 26th. (Convention date, November 17th, 1914, Denmark.) (Complete.)

15,148. "Device for the protection of electric installations against excess voltage." SOC. GENERALE DES CONDENSATEURS ELECTRIQUES. October 26th. (Convention date, October 26th, 1914, Switzerland.) (Complete.)

15,186. "Alternating-current motors." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., U.S.A.). October 27th.

15,196. "Device for the protection of electric installations against excess voltage." G. GILES. October 27th. (Convention date, October 27th, 1914, Switzerland.) (Complete.)

15,209. "Electro-magnetic projectile-transmitting apparatus." E. BACHELET. October 28th.

15,222. "Combined electric lampholder and detachable shade support. G. ST. J. DAY. October 28th.

15,237. "Wireless signalling systems." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., U.S.A.). October 28th.

15,246. "Electric rotary converters." G. A. JUHLIN. October 28th.

15,247. "Electric rotary converters." J. A. KUYSER. October 28th.

15,287. "Automatic and semi-automatic telephone systems." RELAY AUTOMATIC TELEPHONE CO., LTD., & W. AITKEN. October 29th. (Complete.)

15,303. "Systems of distribution for electrically-operated railway trains." P. S. TURNER. October 29th.

15,304. "Controllers for electrically-driven vehicles." P. S. TURNER. October 29th.

15,330. "Switching devices for the low-tension induction circuit of automobile engines." F. BACON. October 30th. (Complete.)

PUBLISHED SPECIFICATIONS.

1914.

14,146. ELECTRIC SWITCHING DEVICES. F. N. Pickett. June 12th.

14,224. ELECTRIC BLASTING-FUSES OR THE LIKE. V. F. Feeny (Fabrik Elektrischer Zunder Ges.). June 12th.

16,343. TELEGRAPHY. E. C. R. Marks (International Quadruplex Co.) July 8th.

18,511. TRANSMISSION OF ELECTRICAL IMPULSES OVER TELEPHONIC CIRCUITS OF HIGH ELECTROSTATIC CAPACITY. G. Musso. August 10th. (Patent of addition not granted.)

20,714. APPARATUS FOR BLEACHING BY ELECTROLYSIS. J. F. Webb & Sir W. W. Williams. October 8th.

20,721. ELECTRIC HEATERS FOR MINING AND FOR OTHER PURPOSES. J. R. Quain. October 8th.

20,776. ELECTRICAL IGNITING APPARATUS FOR INTERNAL-COMBUSTION ENGINES. F. E. Wilson & W. H. Shepherd. October 9th.

20,805. SHIPS' TELEGRAPH APPARATUS. J. C. Clarke & Chadburn's (Ship) Telegraph Co., Ltd. October 10th.

20,896. ELECTRIC AUTOMATIC TUMBLER SWITCHES. H. C. Heath & J. P. Keith. October 13th.

21,055. AUTOMATIC PAGE FEED FOR PRINTING-TELEGRAPHS OR TYPEWRITERS. D. Murray. October 16th.

21,710. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. Electric Ignition Co. (1913) & A. Cox. October 29th.

22,062. ELECTRIC GENERATORS FOR LIGHTING MECHANICALLY-PROPELLED VEHICLES. H. C. H. Smyth. November 5th.

22,199. ELECTRIC SIGNALS. A. C. Brown. November 9th.

23,050. LOOPED-IN SYSTEM OF ELECTRIC WIRING, AND FITTINGS THEREFOR. F. W. Suter and Baxter & Caunter, Ltd. November 25th.

24,498. TELEGRAPH SYSTEMS AND APPARATUS THEREFOR. British Insulated and Helsby Cables, Ltd., & H. H. Harrison. December 22nd.

24,692. LIQUID RHEOSTATS. D. Welge. December 28th.

1915.

884. ARC LAMPS. J. W. Allison & T. Hadaway. January 19th. (December 10th, 1914.)

2,636. ELECTRIC ORDNANCE. T. G. Tulloch. February 18th.

2,787. ELECTRICAL PRESS BUTTON SWITCHES. E. Ottinetti. February 20th. (February 23rd, 1914.)

2,865. ELECTRO-MAGNETIC DEVICES FOR EXTRACTING FOREIGN SUBSTANCES FROM PAPER PULP. A. J. Newell & R. J. Marx. February 22nd.

5,498. MANUFACTURE OF ELECTRIC CONDENSERS. Meirowsky & Co., Akt. Ges. April 12th. (July 23rd, 1914.)

5,578. CABLE SUPPORTS. O. W. Brenizer & D. L. Short. April 13th.

6,457. ELECTRICAL FIRE ALARM SYSTEMS. Siemens & Halske Akt. Ges. April 30th (May 1st, 1914).

6,715. ELECTRIC GENERATORS FOR LIGHTING MECHANICALLY-PROPELLED VEHICLES. H. C. H. Smyth. May 5th. (Divided application on 22,062/14, November 5th.)

9,015. MOTOR-ACTUATED ELECTRIC SWITCHES. Landis & Gyr Akt. Ges. June 18th. (July 14th, 1914.)

9,509. ELECTRIC LAMP STANDS. Wallace Novelty Co. June 29th. (July 13th, 1914.)

9,806. ELECTRIC SWITCHES FOR CONTROLLING LIFT OR OTHER MOTORS. J. A. Steven. July 6th.

10,054. TELEPHONE LOCKS. J. E. Lavalley. July 9th.

10,251. ELECTRICAL CONDENSERS. W. H. Wilson. July 14th. (Addition to 19,506/14.)

11,139. SWITCH DEVICE FOR CAR-LIGHTING AND LIKE DYNAMOS. Albion Motor Car Co. & T. B. Murray. July 31st.